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PRICES IN THE CLOTHING INDUSTRY

by N. BALKIN

I

INTRODUCTION — DISCUSSION OF OUR BUSINESS

THE clothing industry manufactures an immense variety of garments ranging from the sheerest of women's underwear to the heaviest types of men's protective clothing, and as would be expected a high degree of specialization of product exists. It should, therefore, be stated at the outset that the present remarks refer to a family manufacturing business of medium size (about 200 employees) producing a wide variety of men's and boys' raincoats and lumber jackets. The raw materials, e.g. cloths, are purchased in the piece from mills and merchants, and all the processes required to convert the piece goods into complete garments are performed in the factory. Firms manufacturing clothing are usually termed 'makers up' and a few words about the early history of our firm may be found useful.

The business was founded in the early 1920s by my father on a very small scale, and with capital which was the result of his savings, and there was a steady growth until 1939. In the beginning, the main lines had been ladies' and men's mackintoshes (i.e. rubberized raincoats) and these continued to be the main products until about 1934-35. For a few years previously competition had been becoming more intense and many orders were obtainable only at prices which did not show a profit. My father had therefore begun to look out for a different product to manufacture and he eventually found one in lumber jackets which he manufactured in a variety of textile materials as well as leather. These were well in production by 1935, and in this year also men's raincoats made from chemically shower-proofed gabardines were added to the range, and rubberized mackintoshes were allowed to peter out. It was at this time, therefore, that the foundation of our present trade was laid, and various types of lumber jackets soon became the main production.

By 1939 the business had expanded considerably, was producing a better type of product and several overseas markets had already been found, principally in the Union of South Africa and the Scandinavian countries.

The war brought many changes. Production was switched from civilian to service requirements, and, at the same time, greatly expanded. The factory was totally destroyed in 1940 through enemy action and accommodation was secured in premises far too small so that a large number of outdoor makers had to be employed. (An

outdoor maker's main business is making up for other makers up — i.e. he works mainly for the making up trade and has few, or no wholesale or retail customers of his own.) The end of the war saw a change to civilian production which was limited only by the difficulties of obtaining labour and materials. In 1948 a new factory was built and we made ourselves ready to meet the intensive competition which, it was felt, the future would bring.

Today, after several years of operating in conditions of boom and recession we have settled down with an average labour force of approximately 200, and we continue to produce men's and boys' raincoats and lumber jackets in the medium to better grades, but with raincoats the dominant production. Something like one-third of our output is exported to over thirty countries, mostly within the Commonwealth, and some take mainly lumber jackets, while others take mainly raincoats, but this proportion of exports is widely elastic and it could easily be altered by a relaxation or tightening of import controls in overseas countries. At the present moment many of our best markets, especially for raincoats, are closed, and if these were open at all freely to us we could probably sell the product of 750-800 operatives — if they could be found.

Very few of the overseas countries in which we sell have a wholesale system as fully developed as in the United Kingdom and, consequently, our sales in these countries are confined almost entirely to retailers, but in one or two countries, while we sell direct to the retailer in the larger towns, we have also appointed a firm of wholesalers for a given area whom we supply exclusively, and they serve the outlying districts. In the United Kingdom, our sales are made to wholesalers, mail order firms and multiples.

II

HOW PRICES ARE CALCULATED — THE COSTING PRICE

The actual mechanics of price fixing is a fairly simple matter. We distinguish our own 'cost of production' from the costs of material used. Once the specifications of the garment to be produced are known, a cost sheet is prepared on which are detailed estimates of all the separate direct labour costs to be incurred, and an amount to cover overhead costs is added to give the 'cost of production'. Wages paid to operatives for cutting, sewing, pressing, buttoning, etc., the garment, are examples of direct labour costs — in fact all the items enumerated on the left-hand side of the costing sheet, which has been reproduced at p. 5 — and examples of overhead costs are salaries, insurances, stationery, travelling expenses and advertising.

The precise amount to be added to cover overhead costs is obtained by extracting from the annual accounts for the most recent financial year the amount paid during that year for direct labour, and the total overhead costs as shown in these accounts; then the latter is expressed as a percentage of the former. This percentage figure is applied to the total estimated direct labour costs for the garment in question and, as already said, the resultant amount is added to that total to give the 'cost of production'. (Economist readers should perhaps be warned once again that this term is used in this special sense in our cost sheet.) The quantities and cost of the various materials we expect to use[1] in making the garment are also detailed on the cost sheet, a small percentage being added for waste, and the 'cost of production' is then added in. To the resulting figure further percentages are added to cover discount to be allowed and commission to be paid, and to cover profit; the final figure, rounded off by a penny or two, if necessary, to get to a convenient amount is almost invariably adopted as the home selling price. The words 'almost invariably' allow for the, on the whole rare, deviation discussed in Section IV. For convenience, the price arrived at on the cost sheet will be referred to as the costing price.

It will be clear from the above, that as far as the calculation for overhead charges is concerned, we are using in Year 2 information gained in Year 1, and we are, at the moment, considering introducing a cost control system integrated with our financial accounts to overcome this difficulty as well as to give us a better grasp of our costs in general, but more will be said of this in a later section. It will also be apparent that overhead costs are not broken down departmentally, i.e. factory overheads, administrative overheads, and selling overheads, etc. but that they are lumped together to give one figure.

The method outlined above is always used to determine a price and the price arrived at is very closely related to actual cost. While the costing price is, in the majority of cases, adopted as the actual selling price, there are occasions on which a different selling price is finally fixed, and these will be dealt with in Section IV.

To give point to the above remarks, however, an actual cost sheet for a typical raincoat is reproduced below, its price having been

[1] In men's garments it is usual to offer a range of sizes, i.e. chest sizes 34-inch to 44-inch at one price and quite often a choice of lengths also, i.e. shorts, regulars and longs. Length of coat is, to some extent, a question of style, and a costing will be made for an average size. (See the costing sheet reproduced on page 5 which shows the estimated cloth consumption of a 38-inch chest, 47-inch length.) Most manufacturers will undertake 'outsizes' or 'special measures' at an appropriate extra charge. Boys' garments are usually offered at separate prices for each size, or alternatively the total size range is broken down into several small groups of sizes, each of which is offered at a separate price.

determined by the method outlined in this section: and the costing price of 115s. 3d. was fixed as the selling price.

In contrast with this is the case of a boy's lumber jacket whose costing price was 25s. 8d. and for which a selling price of 25s. 2d. was fixed. This jacket was made to the specification of an important and regular buyer, who places large quantities with us, and he was quoted the costing price of 25s. 8d. He told us that he had a sample of a very similar article, from another manufacturer, a few pence cheaper, and we eventually agreed to accept 25s. 2d., at which price the order was finalized. I do not think that we really had any need to sacrifice the 6d. difference, as our experience is that at the time of the year when these goods are required our capacity is always fully booked, and the loss of this order would merely have meant that we would have been able to accept other orders at a later date, which accepting the order in question would have prevented us from taking on. It might not have been true that our customer had a cheaper offer, and, if true, we might still have secured the order even at the slightly higher price because the quality of our service is a known factor to him. Nevertheless, we accepted this order for a variety of reasons — we did not wish the buyer to look elsewhere and so provide ourselves with an additional source of competition in the future, and we wanted to maintain uninterrupted supplies of our goods (which are labelled with our brand) to his shops. There is also the point that the large order of this kind, with a long run on one style, is not typical; it brings many economies in the factory and offices, enables us to run at a higher rate of output and so lowers our overhead costs per unit. If we did not take this order, while we might still fill the factory, our costs would be higher.

The extent to which production is increased by a large order giving long runs on one style can be quite surprising. I recall some weeks when one section, engaged on only one style, has produced over 1000 garments per week, and others when the same section, working on several different styles, has produced only about 800 garments per week. This has been true even when the style giving the long run has been a more difficult one than those comprising the smaller runs, i.e. more difficult in the sense that it takes more sewing time — or at least did do so when timed out as a sample at the time the style range was constructed. Orders containing these long runs are, therefore, eagerly sought, even at the cost of some price reduction. It is worth while pointing out, however, that the production figures just given assume other factors constant apart from the style difference, but we do not know with complete accuracy if this is a valid assumption. For instance, the supervision may not have been

a constant factor during the weeks in question — an important matter where the age group of the operatives is 15-18 years. It should be mentioned, in addition, that orders of this type are also accepted because of an ingrained dislike of turning business away if it can possibly be avoided, and as an insurance against the possibility that anticipated bookings may not materialize, on the principle that a bird in the hand is worth two in the bush.

COSTING SHEET

Cloth No. 4382 Price 18/6 yd. Width 60" Maker A.N.Other Their No. A/356 Date 1/8/55
Style No. 537
Description: Gent's D.B. Belted Inset. Art Silk Satin Lined Throughout.

Machining	7	7½	QUANTITIES OF MATERIALS USED				
Bonus and Time Increases on Machining			Cloth 2·28" 47/38" 60" Width	18/6		51	4¾
Pressing	1	3	Body Lining 212" AIS Satin				
U. Pressing		2½	Sleeve Lining QUAL.123. 54" Width.	5/6		12	10
Finishing		5	Syddo QUAL. 337. 1·9" 24" Width.	2/3		2	9¾
B. H. and B. T.		2½	Jute				
Buttoning		3½	Canvas 18" 24" Width.	1/6			9
Tailoring Grade 3	2	4	Collar Canvas 6" 24" Width.	1/11			4
P. F. C.		6	Batiste 8" 36" Width.	3/6			9½
Packing		3	Buttons 6/45 8/22 2/40				10
Cutting	1	4	Buckles ONE 2½" L.S.				4
Extras			Sewings				7
Time Increases or Sectional Bonus			Labels, Tickets, Hanger.				3½
			Tape 4 Yards.				4
			Extras Pocket Lining 7/8 Skeeta 36" Width	2/10			6¾
			Pads, Wadding, Breast Pieces			1	0
Cost of Production	13	11				72	10¼
Overhead 110 %	15	3¾	2½% Less and Waste			1	9¾
	29	2¾	TOTAL			74	8
			Cost of Production			29	2¾
						103	10¾
			3 % Commission			3	1½
						107	0¼
Wholesale Price: 115/3D			2½ % Discount			2	8
						109	8¼
			5 % Profit			5	5¾
			TOTAL			115	2

III

OUR PREVIOUS SYSTEM: EFFECTS OF DIRECT SELLING TO RETAIL TRADE

This particular method of fixing price — or perhaps I should say, estimating cost — has not always been used. It is a legacy left by the Board of Trade in the days following the outbreak of the war when the utility scheme was in force. Previously the method had been somewhat similar in that direct labour cost and direct material cost were estimated and then added together and the result was grossed up by a percentage to cover gross profit, this percentage being derived from the most recent financial accounts. The gross profit percentage had to cover overhead costs of all descriptions together with other expenses such as commissions and discounts and also profit. The mechanics of this method was, therefore, rather more simple than the present method, and it was used up to the outbreak of the war when it had to be discarded, the reason for this being the introduction under the utility scheme of the cost plus system, under which manufacturers were allowed to make a net profit of 4 per cent. As the costings were subject to inspection by Board of Trade Inspectors, they had to show an identifiable amount added for profit, whereas the earlier method which added a gross profit percentage was not acceptable as it did not show such an identifiable amount.

Manufacturers selling direct to retailers may advertise nationally or not, but in either case there will be several important considerations to take into account in their pricing policy which may be mentioned at this stage.

(1) Their factory overheads will be higher than those of manufacturers selling to the wholesale trade, as retailers require a better grade product,[2] and this involves a more expensive set up.

(2) Selling costs will also be higher, owing to the fact that several salesmen must be employed to effect the necessary coverage. Advertising costs will normally be very much larger, and, in the case of a nationally advertised garment, may be a significant proportion of the selling price.

[2] The increasing use of nationally advertised brands has caused retailers stocking the better grades to purchase direct from the manufacturer, the wholesaler being left to serve the retailer who stocks the lower grades. In any town a relatively small number of retailers account for a significant amount of the total volume of business, and as these are usually in the best shopping areas, they can be called on without too much difficulty by manufacturers' representatives who, in times of reasonable trade, can obtain the required amount of business. The retailer occupying a poorer trading position could not place sufficient business to make it worth while the manufacturer's representative calling on him, but the wholesaler's traveller will call on him with a large range of merchandise, of which raincoats is merely one line. In effect, these are two different trades as far as the raincoat manufacturer is concerned.

(3) To service their stockists they must make and keep stocks, the financing of which is costly.

(4) If they have advertised their prices in the press, they will feel obliged to keep their prices stable over a longer period than the manufacturer selling to the wholesale trade — e.g. the former would prefer to absorb a small rise in costs rather than disturb his announced prices, but the latter could alter his prices at once.

IV

DEVIATIONS FROM COSTING PRICE[3]

Having arrived at the Costing Price, it remains to discuss its practical application. If the garment in question is being offered abroad a percentage is added to the Costing Price for the following reasons:

(1) Agents' commission abroad is invariably higher than at home (expenses are higher, greater distances have to be covered).

(2) There are greater risks abroad than at home, e.g. goods may be sent to a customer on Sight Draft, and he may not take up the goods if business has deteriorated since he placed his order. Consequently, we have to bring them back, pay the charges involved, and we may then have to job out the goods, often much below original cost, especially if they have been made to the customer's requirements. A firm order could, of course, in most cases be enforced, but international litigation is not lightly undertaken, and, indeed, any sort of litigation is comparatively rare in an industry which competition causes to be peculiarly sensitive to the retention of a customer's goodwill. (It is possible to insure against certain special types of risk, but normally the whole turnover must be insured, and it has been found cheaper to bear these special risks ourselves.)

(3) Certain types of costs are greater, e.g. better packing is needed. We may have to cover for insurance, etc.

(4) Complaints are not so easily dealt with as at home and the price of a garment may have to be refunded, if the subject of a complaint, whereas in the home market it could often be repaired at a much smaller cost.

Items 2 and 4 are, of course, not capable of exact assessment and therefore the percentage added for export includes an allowance of a small extra margin designed to cover such contingencies. In so far as these contingencies arise, however, it is incorrect to term this allowance a 'profit' margin. When selling abroad, the Costing Price

[3] My father's comment on this section was that it 'gives the impression that we are always changing prices'.

plus the export percentage is nearly always taken as the selling price, variations from this being very few indeed, and the reason for such variations as have occurred are the same as those which occur when selling in the home market.

In the home market, a price will be offered at less than the Costing Price in the following circumstances:

(1) In order to clear discontinued lines and out-of-date or unfashionable stocks. The mere decision to accept even a substantially reduced price for these goods will not guarantee its acceptance. Because of their very nature they will be most difficult to sell, and the only buyers will be buyers of job lots, or those with whom price is almost the only consideration.

(2) In order to offer a buyer of regular lines a sale line for his annual or twice yearly sales. Before the half or end yearly sales there will be many requests by buyers for 'sale lines'. These may be slightly imperfect goods — either our own rejects because of faults or damages in production or else garments specially made from slightly sub-standard cloth purchased below the price for perfect goods and specially made with a view to disposal as a 'sale line' — or they may be perfect goods which the buyer expects to buy substantially under the regular price. As we have very few rejects and do not buy imperfect goods ('seconds') such sale lines as we are likely to be able to offer would be:

(*a*) Discontinued or out-of-date lines (see 1 above) or

(*b*) one of our own regular lines which we would be willing to offer at a reduced price — this reduction could only be quite small, however, and would invariably be too small to meet the buyer's purpose, but we would feel obliged to attempt to find a sale line for a buyer of regular merchandise, or

(*c*) garments made from perfect cloth which we have been able to purchase under the market price, and which, for the purpose of cheapness, we may make up in a cheaper make or smaller pattern, and on which we may also depress our profit margin, all depending on how much below market price the cloth was purchased.

(3) When tendering for Government contracts. These are awarded by competitive tendering and experience shows that we can expect to receive a contract only when the overhead percentage is about two-thirds the normal percentage. This may seem to involve a fairly heavy loss, but, in fact, a considerable economy can be effected because of the long production run, which a cost sheet for an individual garment cannot show, and at the same time it provides us with a means of training labour on a standardized article over a ten- to fourteen-week period, and it is also a form of insurance against

bad civilian trade. Hence, these contracts perform several useful functions, not the least of which is that they do provide some contribution towards our overhead expenses, whereas without them in a period of bad trade we should have to make possibly heavy stocks which provide no overhead contribution until they are sold, and then there are the attendant risks of making the wrong styles or the wrong qualities or shades, with the consequence that they may have to be sold at very greatly reduced prices. The only alternative to making stocks in times of bad trade would be to lay off operatives, and this would be done only as a last resort as they would be lost, in many cases, to other trades.

(4) To a large-scale buyer, but here two cases should be distinguished:

(*a*) In times of brisk trade we should probably not accept a price lower than our Costing Price since there would be no need to do so, but we may possibly accept such a price from a large-scale buyer whom we have never previously supplied in order to open the account.

(*b*) In the case of a large-scale buyer with particularly wide knowledge of the market we may accept a price lower than the Costing Price merely to retain him on our books and prevent him giving his business elsewhere. I do not believe, however, that this is good practice, as the tendency is to expect a depressed price always, once it has been granted in the past (similarly one important reason why a price above the Costing Price is rarely fixed is that one may always have to retreat and it destroys the ability to stand firm on a price which is known to be keen).

(5) A reduced price will be offered as a result of decreased costs, whether by way of a reduction of material costs or labour costs. In today's circumstances a reduction in labour costs is hardly imaginable; this did, however, happen some time ago when we took in about 25 girls from school and after a few weeks' training put them on a production unit making raincoats for a Government Contract. The coats were sectionized in small sections, the girls were on weekly wages with bonus, and after a few weeks the machining cost was found to be significantly less than the piece workers' rate for the same coat.

Costs may, however, be lowered through an expansion of production involving a less than proportionate increase in overhead costs. The results of lower costs would eventually be passed on to customers in the form of lower prices, but the precise time at which they will be passed on will depend on the state of trade. There would obviously

be no need to decrease prices in a period of brisk trade; this may possibly be done for reasons of prestige, and to engender confidence, and for other rather nebulous reasons, but by and large I think that a reduction in overhead costs would be passed on to customers in the form of lower prices only when absolutely necessary, i.e. only when it seemed that sales were not being made because quotations were too high. This is, however, one of those matters where it is difficult to adhere to a rigid principle. Practice in different sections of the clothing industry may diverge greatly on this point, but in any section where the considerations of competition make it difficult always to hold to a quoted price, I think it must be regarded as important to secure advantages when they arise, and consequently my own opinion is that a manufacturer would not immediately pass on to his customers such a price reduction. In the case of nationally advertised goods, a price reduction passed on in the middle of the season may cause loss to the stockist if he marks down previously purchased stocks to the level of the new, or to the manufacturer if the stockist requests him to credit the difference.

(6) In times of slow trade a price lower than the Costing Price will almost certainly be offered to small and large buyers alike. At the beginning of this period our reduction would be quite small since the urgency to obtain business would not yet be very great, and rather than offer too great a reduction we should prefer to make a certain amount of stock over a selected number of styles, especially those export lines which have been popular for many years and where the risk of making the wrong stock is, therefore, at a minimum. If trade was still slow by the time we had made an uncomfortable amount of stock we should then feel there was no alternative to reducing prices still further, and possibly very substantially (both for stocks and for goods to be made but particularly the former) and if this produced no worthwhile business, and stocks had been made up to the limit of the available finances, the only remaining alternative (save that of shutting down completely) would be to release operatives to the required extent. By the time this occurred, however, we should be in a general recession, at least as far as clothing sales are concerned.

As a firm, we have never found that reducing prices in times of bad trade has effected any significant increase in sales on the two or three occasions when it has been necessary to apply it during the last few years, and several reasons may be advanced:

(*a*) There is today a much tighter financial control exercised in warehouses and stores than pre-war, and, when trade is bad, merchandise would be lying on the shelves and little or no

further buying would be sanctioned until at least some stocks had been sold — the buyer is the prisoner of the Merchandise Manager or the Counting House, or both — even tempting offers may evoke no response until the desired degree of stock reduction is effected.

(*b*) There is a large number of small-scale raincoat manufacturers, many of whom cannot hold out for long in times of bad trade, and while the larger firm is offering at a moderate reduction, the smaller firm is already compelled to offer at a substantial reduction and consequently sets the pace and price climate.

(*c*) These below cost offers travel round the trade with great rapidity and tend to make buyers wait and see whether the next few days will bring even lower offers: confidence is thus undermined, such buying as there is tends to be only for immediate requirements, and orders are consequently small and scrappy.

In what circumstances will we raise prices?

(A) Not just because demand is higher — firstly, this would be unjustifiable and secondly it would be suspect. A continuous period of good or rising demand invariably entails rising costs, which are faced by all firms at roughly the same time, and a price increase on this account would be normal and would provoke no comment. The firm which raised prices solely on account of a rise in demand would be the exception, and such action may cause its customers to regard it as a bad firm and not one to be entrusted with their next season's business as it may increase prices half way through the season when alternative arrangements for supply could be difficult to make. Even if only a small proportion of customers took this attitude the offending firm may well lose more through their defection than it gained by the price increase, and my own view is that it would not be wise to take the risk.

(B) In a period of higher demand unaccompanied by any increased costs, the introduction of another style or two, a little different from those already running, and bearing a margin on top of the Costing Price, may well be one way to increase revenue, and would not have the disadvantage mentioned under (A) above. Of course, buyers may not buy the new lines, but in the conditions stated it should be possible to sell a proportion of the new lines to existing buyers, and others could be channelized on to the new lines from new customers who would only be quoted for these more profitable goods. This may seem to take advantage of a position of high demand, but in an industry where more orders must be negotiated from weakness rather than from strength, with the resulting incursions which are usually

made into a profit margin believed to be already less than that obtaining in more heavily capitalized industries, it is regarded as important to obtain an extra margin here and there when the opportunity can be legitimately taken, and so provide a reserve against leaner times.

(c) Rising costs are normally associated with high or rising demand, and in this case prices would be increased, but we should try not to raise them in the middle of a season, if possible, even if we had to absorb some of the increased costs. Rising costs have, however, also occurred in periods of very slow trade, when it has not been possible to sell the whole output, and in this situation no purpose will be achieved by raising prices to the degree necessary to cover the higher costs (which will include increased overhead costs). In an inflationary period certain costs may be allowed to be rather higher than they would be in normal times. This was the case in the immediate post-war period when there were acute shortages, e.g. it would be unreasonable to refuse to grant to operatives a request for an extra penny for one of the processes on a garment, and so risk losing operatives at a time when labour was acutely short, even if the request were unjustifiable. A decrease of costs will be passed on to customers in the form of reduced prices, but at which time will depend on the state of demand. If demand is brisk, prices will not be disturbed and the extra margin gained will help to create a reserve against leaner times. If demand is poor the decrease will be passed on immediately.

(d) A price higher than the Costing Price may be fixed for certain special reasons — if, for example, a cloth is offered which only a few manufacturers are making, and which is in good demand or which is felt will become popular. Anything 'exclusive' would fall in this category, but in fact very few such opportunities arise in the raincoat section of the trade, and anything bought on a 'hunch' and fixed much above the Costing Price will be very profitable if it sells but could be a considerable loss if it turns out that it is not wanted in sufficient quantities.

V

COMMENTS ON THE COSTING SYSTEM EMPLOYED: CONCLUSION

The costing system which we employ is known to be used by many firms, and in view of its origin is probably in quite general usage, especially among the small to medium size firms. It has served us well for many years, we have remained in business and grown slowly and steadily, and the prices fixed seem to enable us to hold our own. It has, however, several unsatisfactory features:

(1) The overhead percentage figure is arrived at on the basis of information contained in the previous year's accounts, and today's circumstances may be very different. When the business was smaller this may have been of little importance, since the overhead items were fewer and would be known more directly. The larger business will attract more overhead items, and is likely to include some which should either be eliminated or reduced, but these will all too often escape the attention of directors too fully occupied with day-to-day detail work and with insufficient time to think.

(2) The system applies the same uniform overhead percentage to all classes of goods — to those sold at 18s. as well as to those sold at £8 and gives no guidance as to the relative demand on overhead factors of production made by the various classes of goods.

(3) The system tends to disguise the fact that the costing sheet is only an estimate, and to induce the feeling that it represents facts. The estimate may indeed be fairly accurate, but if it is not periodically compared with actual costs (such as a cost office would produce in the form of, say, monthly summaries of labour, material and overhead costs in respect of specific jobs) then there will be no accurate knowledge of actual performance.

(4) The system offers no real guidance as to the relative profitability of the different types of garments, and therefore gives no guide to action.

(5) The system does not differentiate between those (variable) overheads incurred as a result of making this or that product — e.g. supervision, and those which may be called fixed Establishment Expenses, which are incurred almost irrespective of the scale of production, by virtue of being in business at all — e.g. maintenance of buildings. In times of bad trade an order will be worth taking at a price which covers prime cost and the appropriate burden of variable overhead expenses, and also makes some contribution towards the fixed overhead expenses. Although we do in fact cut our price in times of poor trade by accepting Government Contracts, and fix the tender price by including a much lower than normal overhead figure, we do not really ever know with any certainty how we make out on any particular contract.

It will be clear from these criticisms that I am thinking in terms of a cost accounting system to replace our present methods, and I do, in fact, think that only such a system, integrated with the financial accounts, will give a proper perspective of costs, enable them to be controlled more exactly and provide realistic information on which to act intelligently. As a result of these thoughts a firm of consultant

cost accountants was brought in to investigate our cost position. Their recommendations are that the introduction of a cost accounting system incorporating budgetary control and integrated with the annual financial accounts would increase the profit-making ability of the firm, and provide us with a more flexible costing method. These recommendations were received by our management with somewhat mixed feelings. Mainly, it was agreed that under such a system we should reduce any wastage which may at present occur (especially with materials) and that our liquid cash position would be increased somewhat as a result of tighter material and buying controls respectively, but by and large it is felt that the cost of installing the system would outweigh the gain. This view, however, is probably too much influenced by the fact that the cost of installation of the system is known whereas the gain cannot be calculated in advance, and also by certain other psychological factors which will suggest themselves.

Apart from any economies which may result from the greater control which such a system will provide, it is difficult to see exactly how it will furnish a better price-fixing tool (except for any mere simplification of the mechanics of price fixing). The accountants have pointed out (1) the effect on profit if an extra few pence per unit can be obtained; (2) that we do not really know, within small limits, how much we can get for a given garment; and (3) that the aim should be to differentiate the product so that it is worth a little extra. These first two points are admitted, and apply irrespective of the costing system, and I have stressed in earlier sections the importance of earning a little extra where possible, but if we could still further differentiate a given garment we should already be doing so. From time to time such opportunities do arise, however, and those who were among the first to make a raincoat with a detachable zip-in lining may well have obtained prices above the Costing Price; but such opportunities occur rarely and do not last long. Makers with a nationally advertised garment have more opportunity to differentiate, as their sales are more stable, but they would nevertheless have to be careful not to be too far out of line with other such manufacturers. For those not in this category, however, I think it is true to say, in general, that in good times a poor garment will sell, and in bad times it will be most difficult to sell even an excellent one.

Nevertheless we have been encouraged by the accountants' remarks to be a little bolder in trying to make some garments more distinctively 'our own', and we have fixed their prices above our costing prices — by perhaps as much as about 5 per cent. These

experiments have been encouraging and it is too soon to say how far we shall go.

My own conclusion, however, is that such a cost accounting system might well have its main value outside the price-fixing area, e.g. in the information which it would provide as to the relative profitability of the various products. Preliminary results have confirmed our feeling that certain types of garments are more profitable than others, but some are apparently less profitable than was anticipated. If further investigation proves significant differences in profitability as between various garments we shall doubtless want to consider increasing production of the more profitable lines, providing we feel that the extra output can be sold, and to think about contracting out the production of the others. It may, however, be found that the more profitable lines are those demanding the greatest skill in making, and that the labour available does not permit any significant increase in production, but even if this were not the case, and it were possible to discontinue all the less profitable lines and substitute the more profitable ones, we should be reluctant to do this if in consequence the new lines were all of one type. In the past we have found it very valuable to have several sections, and that often when one is quite slack others are busy, so that dependence on any one type of trade is reduced. In this case, therefore, an attempt would be made to increase production of more profitable lines while still keeping a balance over the various sections.

If the more profitable lines were reasonably spread over the sections we should endeavour to run on these alone, providing we felt that the increased production could be sold (or, if not, possibly other lines of equivalent profitability might be taken on), and in this case profit would rise. Extra selling efforts would, however, incur extra costs, but concentration on the restricted number of lines would produce economies and an expansion of production would tend to lower overheads, so that an increase in profit is still likely to result. If, meanwhile, prices have remained unchanged (as well as labour and material costs) it is unlikely that they will now be reduced in order to fall in line with the lower cost basis, unless it was felt that lower prices would produce further business which could be handled or unless they are necessary to keep the existing level of business because of competition.

MANCHESTER

HOW ARE CARTEL PRICES DETERMINED?

by BJARKE FOG

'The theories of the cartel member's conduct in the light of existing agreement and of prospective negotiations should be supplemented by the theory of cartel negotiations. Not only is such a theory not available in well developed form, but unfortunately we do not even have any descriptive accounts. After all, cartel negotiations in the United States constitute criminal conspiracy and we cannot expect the "conspirators" kindly to furnish detailed memoirs about their considerations and activities so that economists may learn and district attorneys may prosecute. Even in countries in which cartels are legal, cartel negotiations are usually secret'. (Fritz Machlup, *The Economics of Sellers' Competition*, Baltimore, 1952, p. 489)

I

CARTELS play an important role in modern industry. Yet we know little about how cartel prices are determined. In most textbooks the formation of cartel prices is disposed of with the remark that cartels can be regarded as a special form of monopoly (collective or collusive monopoly) and that ordinary monopoly theory may be applied; or cartel prices are regarded as the result of a compromise, but without any analysis of how the compromise is reached. Few authors have tried to develop a theory of cartel price formation and they have not had any empirical evidence available to them.[1]

This article attempts to make a contribution to a theory of the formation of prices within price cartels.[2] The contribution, however, will be modest, since the author has met with many difficulties in obtaining factual information about cartel negotiations. The information actually obtained originates from cartels within Danish industries. There is no reason to believe that Danish cartels are different from those existing in other countries where cartels are not declared illegal.[3] Therefore, it is hoped that the observations may be of more than local interest. The information has been obtained by the method of personal interviews with cartel members about the proceedings at the cartel negotiations, supplemented by what other empirical evidence it has been possible to find. As

[1] As examples can be mentioned: Ragnar Frisch, 'Priskartellisk Prisdannelse', *Statsökonomisk Tidsskrift*, 1938; G. Elmers, 'Produktionslänkung und Preisbildung in der Marktform des Kollektiv-Monopols', *Zeitschrift für Nationalökonomie*, 1941; Ivar Sundbom and Holger Bohlin in *Ekonomisk Tidsskrift* 1944; Hans Brems, 'On the Theory of Price Agreements', *Quarterly Journal of Economics*, 1951; F. Zeuthen, *Economic Theory and Method*, London 1955, p. 311.

[2] The theory of cartels consists of two parts: the negotiations about the cartel price and the behaviour of the individual cartel member, when the cartel price is fixed. This article will deal with the first problem only.

[3] According to Danish law cartels are legal, unless their existence implies unreasonable profits, prices or trade conditions, or they, for other reasons, are declared against public interest. Actually very few cartels have been deemed unlawful. All cartels, in order to have juridical validity, have to be registered in a 'Monopoly Directorate'.

regards six cartels it was possible to obtain a more or less detailed description of price negotiations; in some cases with statements from more than one of the participants. Of these cartels two must be characterized as secret cartels.[4] In one additional case I have acted as a consultant to one of the participants in a cartel negotiation. Furthermore, in two cases of unsuccessful cartel negotiations it has been possible to question some (but not all) of the participants as to why the negotiations failed.

It is readily admitted that the material obtained is limited. Therefore, I do not feel able to evolve a comprehensive theory of cartel price determination, but shall confine myself to some suggestions for elaborations of present cartel price theory.

It is a question, however, whether information obtained through personal interviews is reliable. This is a problem which cannot be neglected. The circumstance that all informants were promised anonymity gives some reason for believing that they tried to be sincere. Furthermore, in cases where I was able to obtain information from more than one of the participants, some sort of control was possible by comparing the answers. Unfortunately, the agreement in these cases was far from perfect, and on certain points there were opposing views. It is reassuring, however, that there was substantial agreement as to the most important points.

II

Let us start, however, with a brief summary of present theory of cartel pricing so far as it has been developed by the authors previously mentioned. The case of three firms, A, B and C, in a homogeneous or nearly homogeneous market trying to enter a cartel agreement is illustrated in the figure. The curves in Figure 1 indicate for each firm the expected net profit at each possible cartel price, the price corresponding to the zero point (i.e. the intercept of each curve with the ordinate) being the competitive price in force without agreement.[5] Before the negotiations start, we are in the zero situation, where A and B as indicated are working at a profit while C is making a loss. (The parts of the profit curves below the price line indicate negative profit). Curve A+B+C is the sum of profits of the three firms.

[4] i.e. not registered at the public register in the Monopoly Directorate.

[5] Most authors have used gross profit instead of net profit. This definitely has the advantage that net profit is a much more ambiguous concept than gross profit. If we, for the sake of convenience, assume prime cost expenses to be variable costs and indirect costs to be fixed costs, we define gross profit as the balance of total sales received after deducting changes in stock and prime cost expenses. Net profit is to be understood as gross profit minus indirect costs and provisions. If profit in the diagram is understood as gross profit, it will automatically pay to close down a firm, when its gross profit is zero, which implies that firm C simply did not exist in the competitive situation.

In the present case, A would favour a cartel price at p_a, B at p_b, and C at p_c. Naturally, the compromise price must be expected to

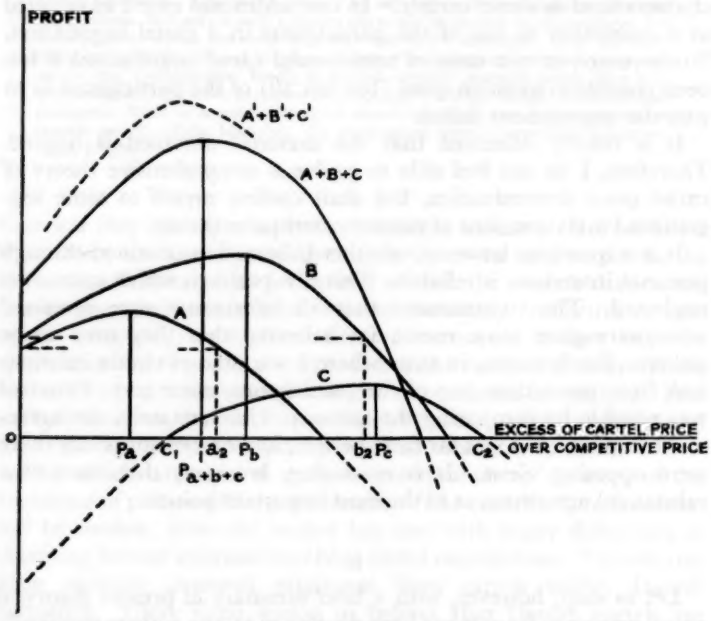

FIGURE I

lie within this interval. But the interval can be narrowed. A has no interest in prices above a_2, because he would then be better off at the competitive price. But C is not likely to accept a price lower than c_1, which is the lowest price which does not imply losses to him. Cartel negotiations therefore may become very troublesome as it is difficult to find a price which appeals to everybody. The probable outcome is that A and B agree upon a price somewhere between p_a and p_b. It is admitted that C may not be happy about that solution but what is his alternative? At least he is much better off than in the competitive situation, and it is not likely that he has a strong bargaining position. Though he is weak, he has some bargaining power, however, since he can threaten A and B with active price competition if they do not pay regard to his wishes.

The possibility that one or more are bluffing must be taken into consideration. You cannot be sure that everybody plays with his

cards on the table. ay, for instance, propose a very low price and finally agree upon a compromise price which is close to p_a. Or C may try to outsmart the two others, making them believe that he is much stronger than he actually is, and threaten with price warfare in an attempt to enforce his will.

The price p_{a+b+c} gives joint profit maximization, but a realization of this possibility may imply a system of compensation between the firms.[6] If the parties can agree upon this price, the cartel may be said to have realized a monopoly situation, and the price may be termed a monopoly price. In case of merger between the firms it may, however, pay to close down the C-plant and concentrate on the two remaining factories, thus making possible the profit indicate by the $A'+B'+C'$-curve.

The case becomes more complicated when the market is not homogeneous, so that the quality of the products is varied or can be varied. It is more difficult to agree upon certain price relations than upon one single price for everybody. For a heterogeneous market the result may be that some of the members of the industry make an agreement, while the others remain as outsiders.

III

The real question is whether a theory such as the one outlined above gives a realistic description of cartel price negotiations, as they took place in the cases studied. The answer must be, that the theory gives only part of the explanation, and it is doubtful whether it is the major part. This is not to say that the considerations described in the theory do not play a role, but other factors seem to be equally important. According to the theory, the main difficulty in obtaining the required compromise should be that the participants have different optimum prices. But in my experience the main difficulty comes into existence because of different views as to what is regarded as the proper line of policy. The expected maximum profit and the corresponding price are not uniquely determined. What is to be considered the maximum solution depends upon whether you take a short-run or a long-run point of view, whether due regard has to be paid to potential competition, risk of Government interference, etc. When the views as to what is the proper cartel price are extremely different, as is often the case, this is more frequently due to divergencies as to what is the best line of policy

[6] The possibility of maximum joint profit is also present in non-cartel oligopoly. The theory of joint profit maximization has especially been dealt with by William Fellner in *Competition Among the Few*, New York, 1949.

than to differences in individual optimum prices. In the cartels studied the larger firms usually preferred a moderate long-run policy while smaller firms seemed to be more interested in exploiting the short-run possibilities.

Often the large firms favoured lower prices than the smaller firms advocated. The reason for this is not to be found in divergent optimum prices, but may at least partly be explained by a more circumspect long-run policy of the larger firms. Another important reason was found in the fact that many price agreements were not loyally adhered to by the members, so that more or less open price discounts reduced the value of many cartels. As a general rule the large and well-known firms hesitated to circumvent an agreement — or at least maintained that this was so — while the smaller firms did not have so many scruples about this, chiefly because they have a better chance of doing it secretly. Hence, the larger firms may have an interest in keeping the cartel price relatively so low that the temptation to give individual discounts is negligible.

The cartel negotiations I have been informed about have been characterized by reciprocal suspicion and distrust, not only as to what would be the optimum level for the others, but also regarding their motives and sincerity. Each participant seemed to concentrate on gaining advantages at the cost of the others, and to be unwilling to give any concession without due reward, and only paying slight attention to anything like maximizing joint profits. Sometimes the attitude of some of the participants seems to have been short sighted and narrow minded. When it is necessary that everybody or almost everybody joins an agreement to make it effective, this may spoil the negotiations. In the two cases, where the negotiations were unsuccessful, it was fairly clear to a neutral observer that a cartel would have been to the benefit of all within the industry. But why did the negotiations fail? First of all because some were more interested in preventing the others from gaining an advantage than in obtaining one themselves. Or to use an allegory: they were more eager to prevent the others from having a bigger part of the cake than themselves, than they were interested in making the cake as big as possible. To carry through successfully a cartel negotiation often requires considerable pressure on the reluctant participants; this pressure may range from friendly persuasion to threat of price war or boycott.

In one of the two negotiations which failed the others blamed one particular firm for the lack of success. This firm, which is one of the largest in the industry, was not willing to enter the proposed agreement.[7]

[7] The firm in question refused to give any information.

In the other industry there was no such obvious reason. The various members of the industry (in total about ten) made various observations of which I shall quote three:

No. 1: 'It would have been to our advantage, if it had been possible to carry through a price agreement, at least about uniform methods of cost calculation, but there did not seem to be sufficient interest for it.'

No. 2: 'Why is a cartel impossible? Because the interests and the viewpoints are too divergent. It is not feasible to have an agreement which limits production because XX has just built a new plant and for that reason they have to utilize their increased capacity. YY also has relatively high fixed costs and hence is interested in a high level of production.'

No. 3: 'An agreement is only possible, if a strong personality with strong will can carry it through. But there is no such personality in our industry. YY could have done it previously, but at present his position is too weak. ZZ may do it, but I doubt that he will try to threaten the rest of us, and that is necessary in order to enforce an agreement. We could possibly do it ourselves, but we are not sufficiently interested.'

Another fact which sometimes may make cartel negotiations difficult is that some may prefer to wait and see what the result will be before they join the cartel, or they may speculate on the possibility that the rest of the industry will form a cartel and then see their advantage in staying outside the cartel and competing against it.

IV

Is it likely that the compromise price in a cartel will be close to p_{a+b+c} (the monopoly price)? Or is it only possible to raise the price a trifle over the competitive level?

As already emphasized, the monopoly price is not uniquely determined, since it will depend upon which policy a possible monopoly will carry out, especially whether it will concentrate on long-run or short-run policy, etc. Consequently, the following remarks can be of a hypothetical nature only.

It is undeniable that some cartels are so strongly organized that it seems justified to regard them as equivalent to monopolies. In such cases it is probable that the cartel theory outlined in the beginning of this article is realistic and that the members may try to realize the p_{a+b+c} situation.

Also in cartels with a looser organization it is possible to maintain a price level somewhat above the competitive price. It is sometimes postulated that cartel prices are high, because the price has to be so

high that it leaves a profit even to the least efficient producers. This point of view is as a general rule denied by the industrialists interviewed. If a cartel price is high, it is so because it gives a good profit to the strong and effective firms. Little regard is paid to the inefficient firms, simply because they have no bargaining power.

On the other hand it seems that the main purpose of many cartels is to obtain security rather than maximum profit per se. Of course, 'security' requires a good profit; but not necessarily maximum profit. From my own interviews I got the definite impression that the participants did not meet at the negotiations with any ideas about which cartel price would give them the best profit. But each of them had an idea about a certain minimum price that nobody should be allowed to cut, and this price was ordinarily based on a full cost calculation, no matter how arbitrary such a calculation may be. Many cartels seem to express an endeavour to maintain what is regarded as fair prices, which is not necessarily equivalent to monopoly prices. Thus it is probably more correct to regard the cartel price as a full cost price[8] than as a monopoly price.

It might be, however, that a full cost price may be identical to what must be regarded as the monopoly price under the existing conditions. Let me illustrate this point with one example. A cartel consists of 9 members: outside the cartel are 4 or 5 smaller competitors. Before a member of the cartel brings a new product on the market, he proposes a certain price. This proposal is sent to the other members, and if they do not have any objections, the price is valid. If the price is not approved of, special negotiations will be necessary in order to find a compromise price that can meet with the consent of everybody. Is it possible under such conditions to realize prices, which are above full cost plus a normal (or fair) profit? This is denied by the cartel members. It is demonstrated that there is competition from the outside; furthermore another industry may take up the production of these goods, and finally there is some fear of Government interference. Hence, there seems to be rather narrow limits for the profit margins.

It is admitted that the concept 'full cost plus a fair or normal profit' is not a clear concept, and it might even be a euphemism for optimum profit. At least in one of the cases it was acknowledged that even though the cartel prices were based on full cost calculations, the profits on some of the goods were 'very good'.

The conclusion must be that in cartels of a vague type — and that includes the majority — it is most correct to regard the cartel price

[8] The term is here to be understood as a 'standard' cost for the article in question plus a fair profit.

as a full cost price, and acknowledge that it is difficult to raise the cartel price substantially above the competitive level. When a cartel grows stronger and the competitive attitude among the co-members weakens, the cartel will gradually become a unit, and in such a case the theory outlined in the beginning may be realistic, and the cartel prices may be regarded as similar to monopoly prices.

But even in a well established cartel the members may retain a competitive and even hostile attitude towards one another and all the time be on their guard — first of all because the cartel may be dissolved again and replaced by competition. This fact definitely limits the potentialities of a cartel. In the extreme case there may still be a high degree of competition even within a well organized cartel. This may be illustrated by the following example, which may not be typical, but which clearly shows how intense a competition there may be within a cartel. The cartel in question consists of seven members, there are no outsiders in the industry, the cartel has been in force for many years, and all the members keep uniform prices, seen from the outside as strong a cartel as you can imagine! The price of the main article has been kept unchanged for more than a decade in spite of rising costs, so that the profit margin has nearly disappeared. In the spring 1955 at the annual meeting of the cartel various problems relating especially to distribution were discussed. Everybody felt that the price problem was the real issue, but everybody hesitated to open the discussion. Finally the third largest seller in the industry took courage and raised the question whether the price of the product was not too low. Immediately the presidents of the two bigger firms declared that they could see no reason for higher prices since they had satisfactory profits (which was not true). Consequently the issue was dropped.

Why did they behave as they did? First of all to show strength. The attitude of Number Three was definitely regarded as a sign of weakness. What the two bigger firms were hoping for was simply to drive some of the smaller producers out of the market — not Number Three whom they believed to be too strong. Though the example may be an extreme case, it does show that it is possible under the guise of a well-established cartel to have competition so strong that it may be termed price warfare.

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FURNITURE FOR THE MASSES

by J. G. Morrell

One of the first things I was told on joining a small firm of retail furnishers was that the wage earners have far more to spend in aggregate than the middle classes. There is nothing startling in this but what really impressed me as the months went by was the discovery that I had not grasped its implications. I had not been aware of the influences which go to determine working-class demand. I had begun by assuming that what influenced me, because I was hard-up, would be likely to influence the working-class customer. A few months later I realized after all, that I knew very little about the spending habits of the working-class consumer. Discussion of the behaviour of the consumer in economic analysis tends to be far too general and I had failed to distinguish between the theory of consumer behaviour and the reality of established practice in a single, narrow consumer sector.

Furniture manufacture is highly competitive, due, in the main, to the existence of a host of small firms selling to a local market, alongside a number of large firms (including the largest of its kind in Europe) selling nationally. Wholesaling has been virtually eliminated, so that manufacturers sell direct to the retail outlets through their own representatives. Resale price maintenance applies to a smaller extent than in other industries largely because of the strength of competition from small manufacturers. In nearly every instance there are several similar products on the market at any one time, so that a retailer can generally switch from one manufacturer to another in order to secure competitive advantage.

Similarly, in retailing there are a large number of units in competition. The 1950 Census of Distribution revealed that there was, on average, one furniture retailer for each 7800 persons. This means that the recognized shopping centre contains a sufficient number of furniture shops to give the consumer a choice of supplier. To that extent the consumer is fortunate. But in all other respects there is little to guard him or help him.

My own firm operated shops in working-class areas in London. Also it operated a shop catering for middle-class as well as working-class customers in a university city. This provided a useful basis of comparison. Hire purchase was financed in part by the Company, and part by a finance house. The Company's finance was assisted by manufacturer's credit (often extended for 3 months and in exceptional

cases for 6 months) and by Bank overdraft. The great bulk of the London business was with working-class customers and approximately 90 per cent of this was on credit terms. At our other shop, where the pattern of trade was more balanced, only 50 per cent of the trade was for credit.

In common with most firms in this class of business, a hire purchase charge was made of 20 per cent for 2 years credit. On my analysis the average cost to the firm of taking an application, checking credit-worthiness, completing agreements and opening the account was £2. Bearing in mind the fixed cost of receiving payment on a weekly basis, the necessary book-keeping, and the current commercial rate of interest on the money advanced, it is unlikely that any profit was made on the hire purchase element for orders of less than £15. In consequence customers placing large orders under hire purchase may be said to have subsidized the small buyers.

This charge was imposed on a gross retail profit margin of 50 per cent on cost. Since delivery, handling and storage costs are high relative to other forms of retailing, the 50 per cent margin is not so iniquitous as it appears. On the other hand under a long period of price control, when supplies were short, retailers had to be content with a 33 per cent margin. During 1955 the margin crept up to an average of 60 per cent in my own firm. This was a general tendency in this type of business and it compared unfavourably with the middle-class store where the margin had been kept at around 40 per cent.

My early astonishment at high margins and high credit charges led me to look further afield at prices and terms. I discovered that in the West End of London it was possible to buy comparable furniture on hire purchase at a total cost slightly below the cash price charged by my own firm to its working-class customers. In face of this, why was it that we in the working-class suburbs (in some cases no more than a 4d. bus ride away from the West End stores) were able to do a thriving and expanding business? This apparent impotence of competition was, to say the least, disturbing.

In effect the answer was not far to seek. Retailing follows a class pattern for the reason that the customers set themselves into a class pattern. I soon discovered that many working-class customers would not risk the possible embarrassment of making an appearance in the salubrious surroundings of a West End, or middle-class store. This being so, they had to take their chance in their own kind of shops. In time this tendency will weaken. Television will be a dynamic influence upon taste and demand and already it is noticeable that young people are less tied by class shopping habits. Yet this is looking a long way ahead. Established tastes and prejudices are not

lightly discarded. In furniture the demand for the glossy product is still dominant.

Class shopping restricts competition, but in itself this is not important, provided that there is competition within each class of shops. Unfortunately, from the economist's point of view the degree of competition is inadequate. In this respect perhaps the biggest hurdle confronting the consumer is the lack of reliable information. Quality, particularly for the lay-man, is extremely difficult to determine. It is almost impossible to determine durability. For instance, one has no idea of the quality of the springing and upholstery beneath the covering. Fabrics are notoriously difficult to judge from appearances and very few people can distinguish between a good and an indifferent carpet. But, generally speaking, since the majority of our purchases are in the monopolistic category, many of us have learnt to make useful comparisons. The working-class customer is in the worst position in this respect. He is not in a good position to study advertisements since he does not read a great deal and he does not take the 'consumer durable type' of magazine. Moreover, he has far less time for his shopping than the middle-class buyer. If the wife is also out at work his shopping tends to become quite incautious. Insufficient time, low rent and good income make him the least discreet of the shopping public.

Comparisons between goods in different shops is deliberately made difficult. In furniture retailing the retailer is constantly on watch to ensure that he is neither advertising, nor displaying, goods which can be undercut by a competitor. The range of furniture is so wide that similar, but distinct, articles can always be substituted for anything which is ostensibly in direct competition. Moreover, like most business-men, no retailer likes price competition, so that no one seeks to win advantage by deliberately undercutting a rival in a way which can be identified. This is for fear of retaliation. Rather, the tactics are to display a range of goods which will not conflict with competitors but which will draw the customer into the shop. Once inside, a campaign of aggressive salesmanship begins.

A salesman is accounted a failure if a potential customer is allowed to escape without having placed an order. This has the effect of frightening the customers from entering this type of shop until they are prepared to buy there. Yet the only available means of forming a judgment lies through the window displays and advertising matter published by the retailer. Since the margins added to those goods which are advertised or displayed in the window are, in many instances, much lower than those ruling throughout the shop the consumer cannot find value simply by looking from the outside.

The range of furniture which can be displayed in the window must be limited by virtue of its bulk. In this respect furniture retailing bears no resemblance to other forms where the customer may inspect a comprehensive range of goods in the window and make useful comparisons between competitors. There is one street in London which contains 13 furniture shops. Rivalry is intense. Yet it would only be through some employee's oversight that the same model could be seen twice in the street at any one time. Only by entering each shop would it be possible to make price comparisons. This would almost certainly prove an embarrassing and objectionable experience.

In the face of this the average shopper is virtually uninformed and at the mercy of the trader. We, as consumers, have to depend upon the integrity of the salesman, hoping that we may rely upon his advice. This may be all very well in choosing between goods in any one shop, but it is of little assistance in forming an opinion about goods in different shops. Also, the search for value is made doubly difficult by the differences in the method of showing prices. It is not obligatory to display the cash price of an article, so that, for example, one may find one shop showing 'Only 8s. 6d. Weekly', another 'Yours for 20s. Deposit', another '£31', another '29½ gns.' and, fortunately, another with the full legend '£31, or £4 10s. 0d. Deposit and 100 payments of 5s. 6d. a week'. Some shops display their standard credit terms, others say nothing. All of this is bewildering and for the working-class customer there is sometimes a greater difficulty. Percentages can be mysterious things to some one who left school many years ago at the age of 14 and whose job since then has called for no arithmetic skill.

Yet the distortion of competition does not end here. Hire purchase itself breeds a certain inefficiency, for relatively few people are able to subject themselves to the discipline of saving and purchases are often determined by the magnetic 'Yours for xs. only'. The hire purchase customer can easily lose sight of the real price of the purchase. A hire purchase sale is frequently a thing of the moment. It is the deposit to be paid which becomes all important and the knowledge that, 'At such and such a shop I can have what I want on credit'. The existing hire purchase customer is particularly prone to this influence. Opening the initial hire purchase account is generally an irritating sort of procedure. To continue at the same shop involves no further effort. Unless its prices are wildly out of line with competitors the old customer will open a new account willingly with little thought of the overall cost.

These well developed tendencies make the impact of the credit

squeeze upon retailing particularly interesting. When I entered the industry in 1953 regulations were in force which required a 10 per cent cash deposit for furniture and repayment within 2 years. In July 1954 these restrictions were removed. At once, in spite of the Chancellor's appeal for restraint, certain firms embarked upon no deposit trading. My own firm gradually worked round to it so that by Christmas of 1954 the increase in trade had become phenomenal. Lengthening manufacturers' order books and delays in delivery — the usual inflationary signs — were common.

The first check came in February 1955. A 15 per cent deposit, 2 years repayment and the cessation of consolidation of agreements (i.e. increasing a hire purchase debt on the same account before the original debt had been paid for, so as to avoid a new deposit) was imposed upon the industry. At once a section of my company's trade, particularly to its old customers, was sliced off. Variations of deposit acted like a variation of price upon the position on the demand schedule. But there is generally some sort of loop-hole in new regulations. In this case for the purpose of the law, hire purchase meant agreements for 9 months and longer. For credit of less than 9 months there was no control so that the no deposit trading was not abolished but concentrated (as it still is) in the non-controlled sector.

The second check came in July 1955 with the raising of the deposit required on electrical goods to 33⅓ per cent. My own firm had newly entered this field, but almost at once the way round the high deposit problem became apparent. We began to hire out television and radio for no deposit. We then did even better in this field.

The increases in Purchase Tax in the Autumn Budget had, apparently, little effect. There was a burst of pre-budget buying, but little fall back afterwards. However in February 1956 the screw was effectively tightened. To hire a television or radio set 9 months rent had to be paid in advance. Thereafter, sales in this category fell alarmingly, and since that date every effort has been made to sell all goods on 9 months credit.

This last point is of interest now that the Board of Trade is publishing statistics on hire purchase. Hire purchase is not the whole of consumer credit. In household goods the emphasis has been switched to short credit trading and the figures for this are not included in the monthly sample. We should not be misled by movements in the hire purchase indices. Consumer credit has undoubtedly declined in Britain, but probably not in the way indicated by the hire purchase statistics. If the field of credit control has to be widened the short-term credit should be brought under review.

The conclusions to be drawn from all of this are hardly pleasing. By and large competition is ineffective. In the first place the field of competition is narrowed through the existence of a class shopping structure. Secondly, consumers are not adequately informed as to the relative quality of household goods and are therefore not good judges of value. Thirdly, retailers seek (and are able) to avoid direct competition, and fourthly, hire purchase has created a strong demand which is not sensitive to price competition. As an experiment it would be interesting to see the establishment of a town market in household goods with retailers competing side by side under the same roof. This would allow the shopper better opportunities for inspection before buying. At present, however, one cannot escape the impression that the consumer, and particularly the working-class consumer, is vulnerable to undesirable trading practices.

ROMFORD, ESSEX

ADMINISTRATIVE COSTS AND SCALE OF OPERATIONS IN THE U.S. ELECTRIC POWER INDUSTRY – A STATISTICAL STUDY

by JAMES MCNULTY[1]

I. INTRODUCTION

THE view that there is a tendency for increasing long-run costs to accompany growth of the business enterprise because of 'difficulties of management' has been all but accepted in economic analysis. Marshall was somewhat agnostic on the subject of long-run cost behavior, and, as a matter of fact, put some stock in the large firm's cost advantages of attending to what now would be called administrative organization matters.[2] His thinking in this area, however, has been rather obliterated by later writers who have just about unanimously taken the position that in reality problems of management must eventually result in higher costs for the expanding firm.[3] Kaldor's idea of fixed coordination as a limiting force in enterprise growth is familiar to all economists, as are the assertions in similar vein of Knight and Austin Robinson.[4] While other writers, notably Chamberlin and Lerner, have seemed to concede the possibility of real division of management labour, they in their turn have emphasized the resulting and eventual need for expensive and stifling bureaucratic control in the case of the expanding enterprise.[5]

This anti-management *gestalt* which has been so pervasive in the thinking of economists on the subject of the business firm has had at least two important and unfortunate implications. In the first place, it has not been customary in the field of economics to undertake empirical studies of administrative cost behavior in its relation to scale of operations of the firm.[6] As a result, a potentially important

[1] The writer wishes to express his appreciation to the Bureau of Business and Economic Research, Southern Section, of the University of California for funds needed for the study and to Mr. Oliver Galbraith III, now of San Diego State College, for his assistance in gathering the data and running the computations.

[2] Cf. Alfred Marshall, *Principles of Economics*, 8th Edition, VI, vii, 1-5; also VI, lx, 4.

[3] See, for example N. Kaldor, 'The Equilibrium of the Firm', *Economic Journal*, Vol. 44 (1934), pp. 60-76.

[4] Cf. F. H. Knight, *Risk, Uncertainty and Profit*, pp. 268-311; Austin Robinson, 'The Problem of Management and the Size of Firms,' *Economic Journal*, 1, 44 (1934), pp. 242-257.

[5] Edward H. Chamberlin, *The Theory of Monopolistic Competition*, Cambridge, Massachusetts: 1942, Appendix B; Abba P. Lerner, *The Economics of Control*, New York: 1944, p. 211.

[6] See, however, Seymour Melman, 'The Rise of Administrative Overhead in the Manufacturing Industries of the United States, 1899-1947', *Oxford Economic Papers*, Vol. 3, February, 1951, No. 1, pp. 62-112. Melman's positive finding for a large sample of companies distributed amongst several industrial classifications is that 'administrative overhead' declines with growth in scale of operations. He was not, however, able to get this result for individual industries.

contribution to the science of business administration has not been made. Secondly, what might be called the subject of administrative economics has been left in abeyance or relegated to the textbooks on management for virtually the whole period from Marshall until the last few years, when it was discovered that there were some problems

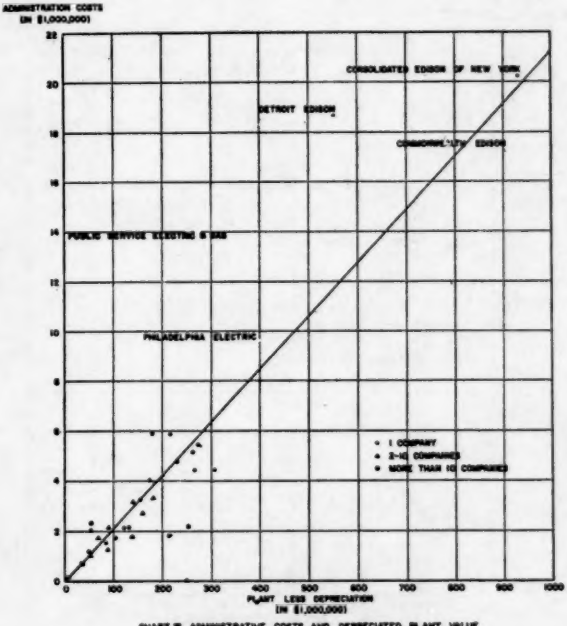

CHART I ADMINISTRATIVE COSTS AND DEPRECIATED PLANT VALUE, SELECTED ELECTRIC UTILITY COMPANIES, 1953

worthy of treatment by economists.[7] Not only has this omission proved embarrassing to the standing of economics as a 'positive' science, but also once again a potentially important contribution to the world's understanding of administrative phenomena has not been made.

The present paper reports on an attempt to remedy the first of the above mentioned problems. What was done in brief was to assemble and compare data published by the Federal Power Commission on

[7] See especially the excellent article by J. Marschak, 'Elements for a Theory of Teams', *Journal of Management Science*, Vol. 1, No. 2 (Jan. 1955), pp. 127-38; also W. W. Cooper, 'A proposal for Extending the Theory of the Firm', *Quarterly Journal of Economics*, Vol. 65. The socialistic economists were of course very much concerned during the '30s and the '40s with what might be described as problems of administrative technique in economics. For an account of this thinking see T. C. Koopmans, 'Analysis of Production as an Efficient Combination of Activities' in T. C. Koopmans (ed.), *Activity Analysis of Production and Allocation*, New York and London: 1951.

administrative costs of private electric power companies with those reflecting size, or scale of operations of the respective companies on a 'cross-section' basis for the two years, 1953 and 1949.[8] The electric power industry is of course regulated and hence is surrounded by complex questions relating to its members' efficiency in a free market

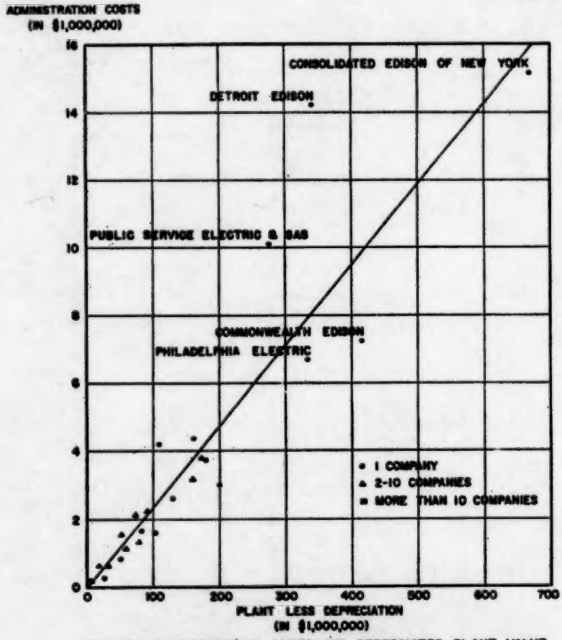

CHART II ADMINISTRATIVE COSTS AND DEPRECIATED PLANT VALUE, SELECTED ELECTRIC UTILITY COMPANIES, 1949

sense. Also the data which were used in the comparison were furnished by the companies themselves in accordance with some broad precepts which govern electric utility cost accounting for purposes of reporting to regulatory commissions and therefore have had to be reclassified to be useful for the present purpose.

It is believed, nevertheless, that the findings are of sufficient interest to be brought forward at the present time. For both of the cross-sections studied, administrative costs and value of plant less depreciation (a measure of scale of operations) are related by a function whose linearity is not denied. These results are presented

[8] Federal Power Commission, *Statistics of Electric Utilities in the United States, 1949*, Classes A and B privately-owned companies, Washington: 1950. *Statistics of Electric Utilities in the United States, 1953*, Washington, 1954.

graphically in Charts I and II. Their derivation is discussed below. What they signify is that modern enterprise perhaps has solved one of its classical growth problems, since one finds here no disproportionate increase in costs of administration as the size of an electric power enterprise increases.

II. THE RATIONALE OF NON-INCREASING ADMINISTRATIVE COSTS

The sense of the findings, as distinct from their formal properties, is defensible first if the idea of division of labor in the management of an enterprise is defensible and second if the possibility of offsetting economies and diseconomies of scale in connection with expanding the size of a management group is conceded. The first idea is central to the management literature, whose whole *raison d'etre* depends upon the reality of a process whereby the preference systems of resource owners may be implemented with respect to the detailed commitment of their resources by hierarchies of hired managers.[9] There is no question but that such a preference system must exist and be used in the management of an enterprise, as Knight, Kaldor, and the others have maintained. Writers on business management have disagreed, however, when it comes to the question of the transmissibility of ownership preferences through human agents called managers. The management writers have taken transmissibility as the usual thing, although they have not been oblivious to certain associated problems as is evidenced by their concern with the organization of decision-making, effective communications, and proper modes of control of subordinate action.

The defense of the position of the writers on management with respect to the existence of a division of labour in the management of modern enterprise is upheld by the results of empirical studies of the modern firm.[10] Given the limitations set by available techniques of measurement, there is every indication that the work of management is divided up when the enterprise increases beyond a certain size. And, of course, as has been suggested earlier above, recent work by economists, especially that being done on the subject of decision-making in the organized firm, is an implicit admission of the feasibility of divided management.

As concerns the possibility of offsetting economies and diseconomies of scale associated with expansion of management groups, this is

[9] Cf. Chester Barnard, *The Functions of the Executive*, Cambridge, Massachusetts: 1938, for description and discussion supporting this statement.

[10] See, for example, R. A. Gordon, *Business Leadership in the Large Corporation*, Washington, 1945; also Richard Alt, 'The Internal Organization of the Firm and Price Formation: An Illustrative Case', *Quarterly Journal of Economics*, Vol. 63.

an idea which at first seems harder to justify in light of all that has been written about the shortcomings of bureaucracy. Also, since administration is currently far from scientific in its general accomplishment, little is really known about the costs of available techniques and devices of administration.

Two points may be made, however. The first is that, in the ideal at least, increasing the number of managers in a business to service a larger scale of operations does not involve duplication of managerial effort with respect to given subjects such that costs of administration must rise disproportionately with size. A basic precept of modern administrative technique is that such duplication is to be avoided, especially through delegation.

A second point is that, as is conceded to be true in other aspects of 'production', there will be certain chances for economy through specialization in accompaniment with increasing the size of the management group. The best evidence in support of this assertion is the widely observed tendency of larger firms to use staff assistants and departments for purposes of gathering and processing data in order that 'line managers' might make better use of their time.

All of this is of course not to imply the inevitability or even the generality of non-increasing costs of administration with expansion in the scale of an enterprise. Increasing costs must be admitted as a strong possibility until more is known about the costs of achieving effective administration. It is conceivable, moreover, that American private electric utilities represent something of an exceptionally favourable case in terms of ease of administration, since they are all local companies in an important sense by virtue of the nature of their operating franchises.

Non-increasing costs of administration clearly do enter the realm of possibility if the general line of reasoning which has been presented is accepted, however. Hence it has seemed appropriate to assess the practical importance of the possibility by reference to the data which are at hand. The privately-owned part of the United States electric power industry has been chosen for first consideration because of a number of factors, including especially the availability of reasonably comparable data for a large number of companies of different size, such that a cross-section analysis of administrative cost behavior in relation to enterprise size is readily done.

III. METHODOLOGICAL ASPECTS OF THE ANALYSIS

Criteria for Inclusion of Companies

The general method of analysis which was used in the investigation follows the usual lines of procedure for cross-section cost analyses. In

the first instance a basis was developed for choosing and excluding companies listed as Class A and Class B private electric utilities.[11] To get reasonable homogeneity in the broad characteristics of the companies studied only utilities which were reported as having some generating capacity were included, i.e. no companies were taken which purchased all of the electric power they sold. Also it was required that companies chosen be something more than producers for other electric utilities, i.e. that power sales by any company to other utilities be less than 100 per cent of its total sales. Finally the study was restricted to companies which generated at least 99 per cent of their power by the steam process, since the production coefficients appear to be quite different as among the three processes currently in use — steam, water and internal combustion.[12]

Ninety-one companies were thus included in the 1953 group, ninety-nine in that for 1949. Each group numbered approximately one-third of the total number of Class A and Class B private electric utilities in the United States for the respective years. Table I shows

TABLE I

SIZE DISTRIBUTION OF SELECTED PRIVATE ELECTRIC POWER COMPANIES IN TERMS OF PLANT VALUE LESS DEPRECIATION

Depreciated Plant Value (Millions of Dollars)	*Number of Companies*, 1953	*Number of Companies*, 1949
Less than 50	44	61
50-100	17	20
101-200	17	13
201-300	7	1
Greater than 300	6	4
TOTAL	91	99

Source of Data: Federal Power Commission, *Statistics of Electric Utilities in the United States*, Section VI

the size distributions for the two groups of companies in terms of depreciated plant value (original cost less depreciation). It is seen that the distributions are both non-normal. Data on the 1953 distribution of sales by the companies among the three important private customer classes are presented in Table II. It is to be noted here that for most companies in the two groups the volume of rural business is quite small and also that, as far as residential-domestic and commercial-industrial business is concerned, the frequency of

[11] 'Class A utilities are those having annual electric operating revenues of $750,000 or more or owning electric plant having an original cost of $4,000,000 or more. Class B utilities are those having annual electric operating revenues of more than $250,000 but less than $750,000.' *Statistics of Electric Utilities in the United States, 1953*, p. vii.

[12] For a discussion of technical aspects of power generation see F. T. Morse, *Power Plant Engineering*, New York, 1953.

companies is concentrated in a relatively few contiguous percentage classes.

Definition of Administrative Cost

The administrative costs of a firm were regarded in the present study as those costs connected with the effective transmission of

TABLE II

CLASSIFICATION OF COMPANIES IN 1953 GROUP BY PER CENT OF SALES TO MAJOR SPECIFIED CUSTOMER CLASSES

Per cent of Total Sales	(*Number of Companies*) *Residential-Domestic*	*Rural*	*Commercial-Industrial*
0 -10.0	3	87	0
10.1-20.0	35	3	0
20.1-30.0	35	1	1
30.1-40.0	13	0	5
40.1-50.0	3	0	18
50.1-60.0	2	0	26
60.1-70.0	0	0	25
70.1-80.0	0	0	13
80.1-90.0	0	0	2
90.1-100	0	0	1
TOTAL	91	91	91

Source of Data: Federal Power Commission, *Statistics of Electric Utilities in the United States*, Section IV

ownership preferences throughout the firm, in accordance with the discussion in Section II above, that is to say, the costs of decision-making, of communications within the firm, and of gaining adherence to the standards which evolve from decision-making. By this definition not only are salary expenses of all officers, 'managers', and supervisors included, but also all other expenses pertinent to the performance of the managerial job, such as wages of staff and clerical assistance, consulting fees, and the like. On the other hand, certain cost elements usually included in 'administrative overhead', such as costs of insurance of facilities, are not included here on the grounds that, while such costs may be necessary to being in business, they are not clearly pertinent to the job of managing a firm.

When the administrative cost concept just described is applied to the Federal Power Commission Uniform System of Accounts, the list of sub-accounts shown in Table III emerges as the definition of administrative costs for purposes of the present investigation. A discussion of some the problems associated with this list in terms of the conceptual standard being used is to be found in Appendix A. The most serious shortcoming of that data on individual company

costs which have been derived on the basis of Table III is that, even with a uniform system of accounting 'boxes', the data are not entirely comparable as among different companies because of variability in standards for allocating costs among the boxes and also because of variability in standards for capitalization of costs. In the matter of differences in allocations among the boxes, the

TABLE III

ADMINISTRATIVE COST ELEMENTS
(DRAWN FROM FEDERAL POWER COMMISSION UNIFORM SYSTEM OF ACCOUNTS FOR ELECTRICAL CORPORATIONS)

I. All supervision and engineering expenses in production, transmission, distribution, customers' accounting and collecting, and sales promotion
II. The following components of 'Administrative and General Expenses':
1. Salaries of general officers and executives
2. Other general office salaries
3. Expenses of general officers and general office employees
4. General office supplies and expenses
5. Management and supervision fees and expenses
6. Special services
7. Legal services
8. Miscellaneous general expenses
9. Maintenance of general property
10. General rents
11. Joint expenses – debit
12. Joint expenses – credit

problem has been approximately resolved in this study by dealing with the totals of administrative costs derived from Table III. It was, however, not possible to effect a remedy for differential capitalization practices, and hence some of the scatter around the relationship between administrative costs and enterprise size (shown in Charts I and II) is to be expected for this reason.

Scale of Operations

There are several possible measures of enterprise size which might be used in a study of the present sort. Availability of data in reasonably comparable form restricted this list of possibilities to three — kilowatt hour sales, kilowatt generating capacity (kilowatt hour capability) and investment in physical plant at original cost less depreciation. Although all three distributions appeared to be highly correlated according to a linear relationship, the latter measure, i.e. the net plant account, was preferred on the grounds that, including transmission and distribution facilities, the net plant account would give a more inclusive estimate of scale of operations than would kilowatt hour capability, a measure presumably derived by reference to generating facilities, and that the net plant account is not subject

to some of the random disturbances which may affect the sales of individual companies.[13]

The chosen measure of scale is of course not without its problems. Net plant includes 'stand-by' generating capacity for periods of peak loads. Fortunately the problems of data comparability which emanate from this fact are somewhat offset by the similarity noted above in the sales patterns of the companies which have been studied. One would expect this similarity to be carried over to the ratios of stand-by to total generating capacity.

Another problem, which pertains both to physical and value measures of plant, is lack of comparability among companies with respect to quality of facilities. Presumably poorer quality of equipment would raise the production coefficients for the other productive agents, including management, for a given company. While it was not possible to assess this possibility and hence its influence on the comparability of the data, it is probable that the combined effects of public regulation and industry trade association activities prevent great extremes in the comparative quality of facilities of companies included in the selection.

Statistical Treatment of the Data

In keeping with the suggestions of *a priori* reasoning, which allows for a number of possible influences on administrative cost besides enterprise size, the relationship was initially taken to be a multiple one according to the linear equation $X_1 = a + bX_2 + cX_3 + dX_4 + eX_5 + fX_6$, where

X_1 = administrative cost in dollars
X_2 = value of plant less depreciation in dollars
X_3 = percentage of kilowatt hour capability used
X_4 = percentage of rural sales to total sales
X_5 = percentage of residential sales to total sales, and
X_6 = percentage of commercial industrial sales to total sales.

This hypothesis was rejected, however, when for the 1953 group of companies the simple correlation coefficient between administrative costs and value of plant less depreciation turned out to be .951 as compared with a multiple correlation coefficient of .969. For the 1949 group of companies the corresponding simple correlation

[13] See *Statistics of Electric Utilities in the United States, 1953*, Section VI. In some cases the depreciated value of the electric utility was not available. In these cases, the depreciated value was calculated as follows: Original cost of electric utility over original cost of total utility times depreciated value of total utility. This method was checked against data available for other companies and seemed to give a reasonable value.

coefficient was computed at .939. Both simple coefficients are significant at the 1 per cent level.

The accompanying regression equations are, for 1953

$$Y = .1 + .021\ X, \text{ and for } 1949$$
$$Y = -.1 + .024\ X$$

where Y is total administrative costs, as these have been defined above, and X is the value of plant less depreciation, the measure of scale being used. These lines have been drawn in Charts I and II. In neither case is the a-intercept significantly different from zero.

The crucial matter of the linearity of these two hypotheses was put to a standard F-test, which is designed so as to indicate whether or not deviations of the actual from the fitted means of (cost) arrays may be attributed to chance.[14] In both the 1953 and the 1949 cases, linearity is not denied at the 95th percentile level by this test. Hence no higher degree curves were fitted to the data. While the test used actually does not confirm the hypothesis of linearity in the two cases, linearity can be regarded as an acceptable hypothesis by the tenets of scientific method, provided of course that one can find justification for the results on rational grounds.[15]

IV. EVALUATION OF FINDINGS AND CONCLUSIONS

The rationale of the present investigation and its findings has been outlined in Section II above. As far as concerns the formal properties of the findings as the description of a particular relation between two universes, the validity of the results depends upon the appropriateness of the measures which have been used and the operations which have been undertaken with respect to the chosen data.

A preliminary investigation, however, which must be the description given to the present study, leaves many unanswered questions. Of most immediate import in view of the broad significance of a finding of linear administrative cost behavior in relation to enterprise size are the reasons for the scatter about the fitted lines of regression. In particular, while the influence of chance was not calculated, it is to be noted that two of the largest companies,

[14] Cf. Helen M. Walker and Joseph Lev, *Statistical Inference*, New York: 1953, pp. 245ff.

[15] This position is, of course, in distinct conflict with that of Ruggles who argues that, since even slight deviations from linearity in total cost functions imply rising marginal costs, more complicated functions should be fitted. Cf. Richard Ruggles, 'The Concept of Linear Cost-Output Regressions,' *American Economic Review*, Vol. XXXI, pp. 332-35. See also the more inclusive article by H. Staehle, 'The Measurement of Statistical Cost Functions. An Appraisal of Some Recent Contributions,' *American Economic Review*, Vol. XXXII (1942), pp. 321-33. Reprinted as No. 13 in American Economic Association *Readings in Price Theory*, Chicago: 1952.

Detroit Edison and Public Service Electric and Gas (New Jersey) are above the fitted lines of regression in both of the years studied by amounts which seem quite a bit more than those which might result from chance. The fact that both of these companies are generally regarded as unusually efficient and attractive in financial investment circles makes an explanation of the scatter even more urgent.

Two possible causes of variation about the fitted lines of regression have been pointed out in Section III above. One of these is variability of practice with respect to capitalization, such that companies may register higher or lower administrative operating costs depending upon whether they capitalize fewer or more expense items. The other is differential quality of facilities, which will affect operating costs by raising the production coefficients of the other productive agents besides 'plant'. A third possible cause which is to be cited is differences among the companies with respect to employee classification for cost allocation purposes. Such differences are likely to show up in the matter of the lower echelons of supervision with consequent effects on the supervisory cost accounts which are part of total costs of administration by the definitions used in this investigation. Finally, differences in factor prices among different geographical areas could occur in a country as large as the United States and so would be a cause of variation about the fitted lines through their effect on costs, since all of the companies studied have geographic franchises.

In the case of Detroit Edison, which is known to be involved in atomic electric development for commercial purposes, the over-sized sub-account appears to be 'Other (than General Officer and Executive) General Office Salaries'. A safe guess would seem to be that this company has chosen not to capitalize certain of its research costs and so has registered unusually high in terms of adminstrative operating costs.

Public Service Electric and Gas Company has for its over-sized sub-accounts those pertaining to supervision and engineering of transmission and distribution. Direct inquiry with the company brought forth the opinions that the company chooses to capitalize a smaller percentage of such costs than does the rest of the industry and also that the company is operating in an unusually high cost situation.[16]

Without retreating from the nature of the findings of the present study it is quite clear that future investigations of administrative cost behavior would do well to penetrate some of the vagaries of

[16] Letter from Mr. F. A. Keane, Assistant to the President, Public Service Electric and Gas Company.

accounting and administrative practice which have been enumerated. Such further work will probably be even more necessary when it comes to studying administrative cost behavior in other industrial fields. There should also be carefully derived criteria and tests for efficiency in the senses of this word which are relevant. If such additional work is undertaken, we shall not only have a much more complete answer to the question at hand, which concerns the behavior of costs of administration in their relation to enterprise size, but also it is likely that a significant contribution will be made to our understanding of modern administrative practices.

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Appendix A

USE OF REPORTED DATA ON OPERATING COSTS OF PRIVATE ELECTRIC UTILITIES

It is felt that the collection of 'boxes' presented in Table III is the best one for the purpose at hand in terms of available reported data. There are, however, some defects and problems. In the first place, a few of the accounts in Group II obviously can include expenses for other purposes than management. An example is to be found in the sub-account, 'Legal Services', which may have a counselling expense component, directly pertinent to management activities, but which also may have a cost of litigation component, which is not regarded here as conceptually pertinent.

Secondly, the provision of data by reporting firms for the individual sub-accounts involves the usual sorts of fairly arbitrary cost allocation procedures, and practice apparently varies among companies with respect to these allocations. Costs of particular jobs are usually allocated among departments and between capital and current as a direct labour basis, but this is not always the case. Moreover definitions, especially of 'capital' and 'current' vary. Also in cases where companies are in the gas as well as in the electric business a breakdown of various common costs is required.

Thirdly, costs of pensions and welfare activities were not included in the tabulation of administrative costs because of the large non-managerial employee component in that sub-account, and the difficulties involved in reasonable segregation. It is recognized that pension rights and certain kinds of welfare benefits are often used as

a method of executive compensation, and hence that it would be desirable to include a figure for these items in order to obtain a more accurate estimate of costs of administration. However, it was found that for the companies studied, pension and welfare payments closely followed managerial salary payments, apparently according to a simple linear function. Also, it was learned from regulatory officials that pension and welfare costs are generally allowed only if they apply to managerial and non-managerial employees alike and are related in a constant fashion to actual wages and salaries. Suggested is a situation in which managerial pension and welfare costs constitute a rather constant upward adjustment to cost of administration, and, since the only effect will be to raise the level of the administrative cost function, that they can be disregarded in the study primarily concerned with the shape of the function.

Finally the fact of regulation presents certain special problems in the interpretation of the data on cost. It is conceivable that regulatory commissions introduce a bias in such things as capitalization practice, so that the comparability of the data being considered suffers. Another matter of special concern relates to the reality in a market sense of stated administrative costs under the influence of regulation.[17]

It is, of course, very difficult to get at either of these special problems fully in a systematic way, in particular for purposes of 'homogenizing' the data, which are, it will be remembered, filed but not processed by regulatory commissions. As far as the attitudes of state commissions are concerned, however, and any possible conditioning of company practices resulting therefrom, more information is and can be made available.

In the present instance, the several state commissions were polled on their possible use of 'rules of thumb' in the matters of capitalizations and allowance of administrative costs. Their responses, which are reproduced in Exhibit 1, in general profess strict adherence in the case of capitalizations to the regulatory code which requires and allows capitalization of all expenses connected with construction activities and apportionment on a direct labour basis. Only in one case was there any 'rule of thumb' percentage mentioned as a control figure for capitalization. In the matter of allowing various costs of administration a greater reliance on 'objective' standards, such as national averages for companies of similar size, was indicated by the replying commissions. Nevertheless, a substantial majority confessed to no explicit rules of thumb whatsoever.

[17] See J. Bauer and N. Gold, *The Electric Power Industry*, New York and London: 1939, Chapter XI.

The result of this survey, it is to be remembered, throws no light on internal accounting practices of the companies selected insofar as these deviate from ultimate regulatory standards of commissions. Also, with respect to the commissions themselves, it is always possible that implicit rules of thumb have crept into regulatory procedures. However, except for the exclusion of administrative costs connected with construction activities of the companies, there is little tangible evidence of regulatory practice which adversely affects the adequacy of the data for the purpose at hand in any important way.

EXHIBIT I

REGULATORY PRACTICES OF STATE PUBLIC UTILITY COMMISSIONS WITH RESPECT TO CAPITALIZATIONS AND ALLOWANCES OF CURRENT ADMINISTRATIVE COSTS

All states and the District of Columbia were polled. Twenty-four replies were received. The questions and replies may be summarized as follows:

Question 1: What 'rules of thumb' do you follow in allowing expenses for general administration and direct supervision of operations?

Answers	*Number of Companies*
(a) No rules of thumb	15
(b) Qualified rule used:	
(1) National averages	2
(2) Prior years	2
(c) Question not clear, no regulation etc.	5

Question 2: In the event that some percentage of the 'barebones' plant account is applied to get the allowable expenses for capitalization, what is this percentage and is it applied on an over-all basis or to individual sub-accounts?

Answers	*Number of Companies*
(a) No percentage used	17
(b) Percentage used as over-all control	1
(c) Question not clear, no regulation, etc.	6

SMALL BUSINESS PROMOTERS – A CASE STUDY OF COLUMBUS, OHIO

by James E. Wert

The data for this case study were obtained by interviewing 33 small business promoters of Columbus, Ohio; small businesses being defined as firms having a total long-term capital of less than $100,000 at the time of incorporation. For the purposes of this study, long-term capital consists of two components: equity capital and any borrowed capital with a maturity of five years or more.

The promoters of these 33 firms represented 18 per cent of the 180 new incorporations in Columbus, Ohio, during 1953. They were selected by the following procedure: The 180 firms were arranged in alphabetical order. Starting with the first business on the list, every fifth firm was selected, thus a total of 36 firms were contacted. Of this latter group, 33 promoters consented to be interviewed, 2 promoters declined to be interviewed for personal reasons, and 1 firm did not comply with the arbitrary definition of small business stated above since it had considerably more than $100,000 of long-term funds at the time of incorporation. Of the 33 businesses, 14 were manufacturing and construction firms, 6 were wholesaling concerns, and 13 were retailing and service organizations.

Finally, for the purposes of this study, the term 'promoter' means the man who is primarily responsible for getting the small business established, and who intends to remain on the job should the enterprise survive infancy. It is not intended to mean a mere financier with only a transient interest in the business.

TABLE I

SOURCES OF LONG-TERM CAPITAL UTILIZED BY SMALL BUSINESS PROMOTERS IN COLUMBUS, OHIO, DURING 1953

	All 33 Firms		*14 Manufacturing and Construction Firms*		*6 Wholesale Firms*		*13 Retail and Service Firms*	
Source	*Amount*	*Per Cent*	*Amount*	*Per Cent*	*Amount*	*Per Cent*	*Amount*	*Per Cent*
Savings of Promoters	$895,320	86	$491,820	91	$213,500	85	$190,000	76
Relatives and Friends	44,200	5	22,200	4	10,000	4	12,000	5
Business Concerns	102,000	9	26,000	5	29,000	11	47,000	19
TOTAL	$1,041,520		$540,020		$252,500		$249,000	

Sources of Long-Term Capital

The capital necessary to start a new enterprise varies with the nature of the business and the scope of the operations undertaken. A glance at the accompanying table shows there were three sources of long-term capital, namely, (1) savings of the promoters, (2) credit extensions by other business concerns, and (3) loans by friends and relatives. The first source was by far the most common. Five times as much capital was obtained from the promoters' savings as from the combined total of business firms and from friends and relatives.

It appears as though it was almost impossible to form a new small business unless the promoter advanced most of the long-term funds. The funds received from businesses and from friends or relatives were intended merely to supplement those of the promoters. In all 33 cases, the promoter advanced at least 50 per cent of the long-term funds. For all firms studied, 86 per cent of the capital was contributed by the initiators of the new firms. Other business concerns contributed 9 per cent of the long-term funds; their chief reason was to secure another outlet for their products.

Age and Marital Status

By and large, the businesses were started by persons of rather mature age. Of the 33 promoters, 23 were between 31 and 45 years of age when operations were begun. The average age of the entire group was 40 years. This mature age is best explained by the fact it was unlikely that many of them possessed sufficient capital to start a business at an earlier age. Personal incomes of even the better-paid generally did not permit the rapid accumulation of savings. The recognized need for experience also tended to delay them from starting a business sooner. Thirty-one of the 33 initiators of businesses were married. This could be considered typical since a sampling of an age group from 31 to 45 from the population at large would be no different.

Educational Background

Of the entire group, 18 had some college training, and 5 others had trade school educations. Only one of the promoters failed to complete high school, and it should be noted that he was one of the older, more experienced men. The rather high incidence of college training is possibly explained by the fact that central Ohio possesses unusually good educational opportunities for study at the collegiate level.

Previous Experience

Twenty-three or approximately 70 per cent of the promoters were employees in a similar business or previously had partnership interests in a smaller business of the same type. As employees or partial owners, they acquired technical knowledge of the business and generally had an opportunity to accumulate some capital. All of the 23 businessmen in this group stated they would be unwilling to go into a business in which they had no experience. To the suggestion that they could employ others experienced in the industry, a number replied that they would not trust their ability to hire a staff for a business with which they themselves were unfamiliar.

Ten of the promoters, or 30 per cent, had no experience related to their present businesses although all had other business experience. This group claimed that managerial training is of such a nature that it is transferable and equally applicable to the operation of a business producing a different or a familiar product or service. Thus these promoters selected and relied upon other people to do those things for which their technical knowledge was inadequate. This group of ten claimed they did not find operating an unfamiliar business very different from one in which they were experienced.

TABLE II

PREVIOUS EXPERIENCE OF THE PROMOTERS OF SMALL BUSINESS CORPORATIONS ESTABLISHED IN COLUMBUS, OHIO, DURING 1953

Years of Experience Related to Present Business	*Number of Promoters*	*Average Number of Years*	*Years of Experience Unrelated to Present Business*				
			None	1-10	11-20	21-30	31-40
None	10	—	—	4	2	2	2
1-10	12	6	4	4	4	—	—
11-20	4	19	3	1	—	—	—
21-30	6	25	6	—	—	—	—
31-40	1	40	1	—	—	—	—
TOTAL	33	xx	14	9	6	2	2

As seen in the table above, in no instance was any initiator completely lacking in business experience. Of the ten having no related experience, all had a considerable amount of background experience in other areas of business. On the other hand, 14 of the 23 with related experience had no experience at all in other areas.

For 17 of the 33, or approximately 50 per cent, the present business represented their first venture. The remaining 16 promoters formerly had a partial ownership in either one or two other businesses, usually

on a partnership basis. As a rule, they were minority interests and the present firm represented their first opportunity to exert a majority control over a business enterprise. A detailed study of the success or failure of their prior ownership experiences would not be too revealing because of a contamination by factors that exert no influence on the present venture. However, it is a matter of interest to note that three reasons were given by the 16 promoters for severing previous partnership connections. These reasons in order of numerical importance were: (1) the death or retirement of a partner, (2) the dissatisfaction with the majority interests, and (3) the desire to get into a different line of business which was thought to be more profitable.

Economic Factor Causing Formation of the Business

In all cases the business was not incorporated until the promoters had made investigations designed to discover economic justification. As can be seen in Table III, salesmen seemed to be in an exceptionally favorable position to secure valuable sales areas or contracts for special orders. In eight instances, district supervisors or successful salesmen of manufacturing firms secured valuable territories to exploit as wholesalers, manufacturer's agents, or dealers. This was possible because of their favorable sales experiences with the company; thus they were able to secure an exclusive territory before there was common knowledge that the specific territory was open or soon to be open. Because of an intimate knowledge of the merchandise and salesmanship necessary for a particular line of goods they were in an excellent position to assess the potential sales market. They had access to the sales and accounting records of the previous business, and frequently much of the good will was transferable due to consumer preference for the product. In all instances, it was supplemented by the patronage already possessed by the salesman. For instance, in certain trades, i.e. plumbing supplies, road machinery, petroleum products, it is common practice for a salesman to build up a following — a group of customers who will buy from him no matter what his business affiliation. Because of the exclusive territorial privileges and the existing patronage of the promoters, in all eight instances the new firms had had an extensive ready-made clientele.

Closely related to the above cases, in four instances a contract was secured to undertake a specific job or order. Generally, a request for a bid was submitted to the former place of employment. As a rule, the specifications were not within the scope of operations of the firm; hence, the employee secured permission to bid on the job.

Upon notification of a successful bid operations were begun to fulfil the contract. This can best be exemplified by the successful bidding on the installation of 600 heating units which could not be handled by the company to which the request for bid was submitted. Having thus set up the organization, it was decided to carry on after the completion of the original contract.

TABLE III

THE IMMEDIATE FACTOR CAUSING THE PROMOTERS OF SMALL BUSINESS CORPORATIONS ESTABLISHED IN COLUMBUS, OHIO, DURING 1953, TO INCORPORATE

Immediate Factor Responsible for Incorporation by the Promoter	*Number of Firms*
Obtained an exclusive area, either as a wholesaler, manufacturer's agent, or dealer	8
Secured a contract to undertake a specific job or order	4
Secured an option to purchase	4
To carry out further research believed commercially feasible	3
To exploit a demand recognized during previous place of employment	3
To utilize capital made available by capitalists to carry out idea held for some time	3
To take advantage of favorable economic conditions	2
Formed new corporation to capture customers of a former partnership dissolved because of retirements	1
Secured a location in a shopping area at reasonable rental	1
To aid financing	1
To preserve investment extended in the form of open accounts for development costs	1
TOTAL	33

In four cases options to purchase business assets or land were secured, and as a result, the formation of the business took place to take advantage of these options. Two of these represented options to purchase assets of businesses being liquidated and the other two were options to purchase land to be used for subdividing. All four parties were professional men, consisting of two lawyers, a public accountant, and an educator. In all four instances they secured the option by virtue of their professional connections, and each had acquired a detailed and first-hand knowledge of the type of endeavor he was entering.

In three cases the businesses were set up to perfect an idea thought to be commercially feasible. In each case the product was designed

for industrial usage and each venture represented an attempt to make a product superior to that currently being used, but at a far lower cost due to a lower material and labor input. Each initiator had an intimate knowledge of his field, and each conceived the idea in an attempt to lower costs for the firm by which he was formerly employed. For example, one firm was producing plastic gears which were claimed to be as serviceable as those made of the hardest steel.

Closely connected to the preceding cases, three firms were started to exploit a demand recognized as a result of the prior employment of the promoters. In a typical case, one promoter was formerly employed by a shoe company which produced a line of children's dancing shoes. Customers continually besieged the company with requests for information as to a good source of children's 'dancing tights'. Upon investigation, it was discovered that no existing company catered specifically for this type of article. Therefore, an expert was engaged to design a suitable garment, and after several attempts, an acceptable article resulted which could be produced at a reasonable cost. The garment was an immediate success in what now appears to be a growing market.

The next four items appearing in Table III are self-explanatory. However, a brief explanation will be given regarding the last two items. One corporation was set up merely to aid the financing of equipment to be acquired by another small business anticipating a rapid growth resulting from increased sales efforts. Thus all machinery acquired subsequent to incorporation will be sold to the new corporation and then leased back to the operating organization. Finally, a corporation was formed to preserve an investment extended by the promoter to another business for development costs. These loans were capitalized by the new corporation with the promoter thereby receiving a majority interest in the newly-created corporation.

Preliminary Customer Analysis

Every businessman who has a product or a service to market must shape a marketing program suited to his product or service, his customers, and his capital. Once satisfied that the good or service is designed to meet specific consumer needs, the businessman must determine the extent of the specific market in which he will sell.

A formal preliminary customer analysis was made by only a minority of the promoters; these surveys differed very widely in degree. The accompanying table shows the extent of the analysis. The seven promoters who placed reliance upon their ability to carry forward customers from their previous business connections stated

that they have had gratifying results in their attempts to use them as a nucleus around which to build a sales program. Such was not the case with the initiators who contacted potential customers. Seven of the nine stated that virtually their entire sales volume consisted of customers other than those contacted in a preliminary survey. In spite of the fact that these potential customers expressed a belief that such a product or service was needed, they did not follow through with orders after the business began operations. The seven promoters in this group stated that the results generally proved quite disappointing since they placed considerable reliance upon this apparent source of sales. Nevertheless, these businesses were able to compensate in part for his lack of follow-through on the part of those contacted previously by securing sales largely on the basis of satisfied customer references.

TABLE IV

EXTENT OF PRELIMINARY CUSTOMER SURVEY CONDUCTED BY THE PROMOTERS OF SMALL BUSINESS CORPORATIONS ESTABLISHED IN COLUMBUS, OHIO, DURING 1953

Extent of Survey	*Number of Promoters*
Contacted potential customers	9
None – reliance placed on general impressions	8
None – reliance placed on ability to carry forward customers from previous employment	7
Examined past histories of similar businesses	3
Examined drawing power of shopping areas which they thought might be suitable locations	2
Employed outside agency to make survey	2
Demand recognized through previous complementary business connections	2
TOTAL	33

By selecting the type of business they did, the majority of the promoters who chose areas in which they were experienced probably lessened the risk of failure due to unfamiliarity with day-to-day operations; yet, on the other hand, judging from the limited extent of their customer analyses, the new business promoters seemed quite willing to take on very significant trading risks.

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THE ECONOMICS OF SHIFT WORKING[1]

by Francis R. Eels

The Sheffield research into the economics of shift working covers manufacturing and processing industries of various kinds, mainly in the north of England and the north Midlands. Coal mining and transport have been excluded because they present special problems.

It is found that the times of starting and stopping factory work conform to a few distinct patterns or systems. The most familiar of these is work which begins soon after breakfast and finishes at the end of the afternoon, this being a continuation of the traditional routine of life rather than a planned industrial system. In this article it will be referred to as *Normal Day Working*. Its essential feature is that the number of hours of activity of the factory is tied to the number of hours of activity of the people working in it. Consequently the machinery and plant operated under this system stand idle for 15 or 16 hours out of every 24 as well as throughout the week-ends.

By organizing the workers in shifts, the plant can be kept working for many more hours than on normal day working: thus greater output is obtained in relation to the capital employed, which is particularly advantageous where capital charges are high in relation to labour costs. The increased production is obtained without adding to such overhead costs as rent, rates and maintenance of buildings. More shift working would assist the economic operation of the electricity supply industry by spreading the power load more evenly over the 24 hours. These are important economies both for the individual firm and for the country as a whole.

The maximum effect of these economies is obtained by continuous working which is necessary where a factory uses a process which, for technical reasons, cannot be frequently halted. In those cases a *Three-Shift System* is common. The men usually work for 8 hours at a time, changing over at 6 o'clock in the morning, at 2 in the afternoon and 10 o'clock at night. There may be minor variations of these hours, and there are several different ways of organizing rest days by having a few extra men or even a complete 'spare' shift. Continuous working is sometimes ensured by operating four 6-hour shifts, or two 12-hour shifts but these are less common. Why are

[1] This article is based on a paper read to Section F of the British Association at Bristol in September 1955. The research to which it refers was begun towards the end of 1953 at Sheffield University, and is being carried out with the assistance of a grant under the Conditional Aid Scheme for the use of Counterpart Funds derived from United States Economic Aid.

not all factories kept going night and day, year in and year out, by a general use of these systems?

The first argument against continuous working, from the employer's point of view, is that the system is inflexible. He likes some spare time which he can use for overtime work in case of a sudden increase of orders or to complete a contract by a given date, and if there is some gap between periods of work it can be used for repairs and adjustments to machinery. The force of this argument is illustrated by the fact that even continuous processes are quite frequently stopped at week-ends for maintenance and repairs and to change the shifts round. Experience has proved that this is less costly than to have delays while the main productive labour force is in the factory.

The other main reason against continuous working is a social consideration. If the employees know that continuous working is not technically necessary, they object — especially in times of full employment — to a ceaseless round of working one week early mornings, one week late nights, and one week all night. In the hosiery industry in the Midlands, three-shift working was traditional but was not technically necessary, and as a result of strong trade union representations the night shift has recently been abolished.

The employer has to consider the whole well-being of his factory and to avoid anything which might create excessive problems of administration and organization or cause the workers to feel discontented. The social disadvantages have, in any case, an economic counterpart, because the employer has to pay a higher rate of wages per hour to shift workers. This increase in labour cost, together with some other costs which rise when shifts are introduced (factory lighting and perhaps provision of special transport, for example) may be such as to entirely offset the savings on capital and overhead costs effected by an extra shift.

If 8 or 9 hours per day is too short a period of activity for economic reasons, and 24 hours per day is too long for other reasons, the obvious solution is to have two shifts of approximately 8 hours each, giving 16 hours of regular work and leaving 8 hours which can be used for maintenance and repairs or for extra work in emergencies. There are two ways in which this may be arranged. One way is to have *Day and Night Shifts*; the other way is to fit both shifts into the day-time (*Double Day-Shifts*) and close the factory at night except, perhaps, for maintenance and repairs. Both of these methods may be referred to by the term *Double Shifts*.

A typical pattern of activity for a day and night shift system is for the day shift to work from 7.30 a.m. to 5 p.m. and for the night shift

to come in at 10 p.m. and work until 6 a.m.[1] The period from 5 p.m. onwards can then be used for overtime by the day shift workers when required. The men may change shifts every week, fortnight, or month, or else one group may remain permanently on days and another permanently on nights.

With double day-shifts the hours of work are nearly always from 6 a.m. to 2 p.m. for the first shift, and from 2 p.m. to 10 p.m. for the second shift, little variation being possible. Workers usually change shifts every week. Many factories, especially the larger ones, run two or more systems side by side to suit the work in different departments, a frequent arrangement being to have double day-shifts where women are employed and three shifts in the rest of the factory.

If it is decided to make more use of existing plant by working it on a double shift system, there are in theory two alternative courses which may be followed. Using the same machinery as before you can produce twice as much each day as you produced before; or, if the machinery is divisible, you can dispose of half the plant and continue at the old level of output by producing half of it on each shift. In the first case you have to double your labour force to man the two shifts: in the alternative case, having halved your machinery you divide your labour force into two halves, one of which works the machinery on each shift. Assuming that there is no change in productivity *per man*, the improvement in productivity *per unit of fixed capital* is the same in each case, but this does not mean that we can be indifferent as to which course is followed. It is obvious that if double shifts were to become extensively used throughout the country this could only be done with the same workers and half the plant, since we could not double our labour force so quickly as we could reduce the plant in use. This would gradually come about either by existing firms finding that to double their labour force was impossible, or else by some firms doubling their labour force and the others going out of business. Perhaps the latter is the more likely course of events, for we have found that the typical firm which has decided to go over to double shift working is one which is confident that it can dispose of twice as many goods in a given time and which, therefore, makes great efforts to get extra labour and then institutes a second shift without any reduction in the size of its plant. Whether any case has occurred of a less go-ahead firm being driven out of

[1] There are, of course, many variations. Starting time may be 7, 7.30 or 8 a.m., the dinner break is usually an hour which may start at 12 noon, 12.30, or 1 p.m., but is sometimes only half an hour, and finishing time may be 5, 5.30 or 6 p.m. Thus it is possible to make up a week of 44, 45, 48 hours, etc., with or without Saturday working. Many firms finish later on two or three days instead of working on Saturday mornings.

Night shifts vary rather more widely, starting times ranging from 6 p.m. to 10 p.m. A 12-hour stretch from 6 p.m. to 6 a.m. is not uncommon.

business mainly through being starved of labour in this way we do not know, but it seems possible that the pressure of competition might take this form in industries (and therefore areas) where there is overfull employment.

When a firm introduces shift working, the rise in the ratio of output to plant means that interest charges and overheads become less burdensome and there may also be relief by relatively lighter provision for depreciation, but this may vary according to the policy of the firm. Assuming that the output in each 24 hours has been doubled, if the percentage written off the capital for depreciation is kept constant, the rate of depreciation *per unit produced* will now be halved: in other words, the contribution of depreciation to the cost of production will be halved. Alternatively, the firm may double its rate of depreciation, arguing that machinery used for twice as many hours per day will wear out in half as many days, and in this case the rate of depreciation per unit produced will remain constant but the machinery will be written off in half the time.

Among firms using day and night shifts or double day-shifts, we have found some which did not increase depreciation rate when they began shifts, some which doubled the rate, and others which decided on some intermediate figure. The variations are due to the different value placed by the managements on the two factors: amount of wear, and speed of obsolescence. Most machinery is out of date before it is worn out, and on grounds of obsolescence *alone*, one could therefore justify writing off the value at the same annual rate regardless of the number of hours which the machines were running. Nevertheless some extra wear is usually expected if a machine is worked more intensively; and if an attempt is made to take this into account, different firms will arrive at widely different results. Some kinds of machinery wear more rapidly than other kinds, and a complicating factor is that double shifts never do entail exactly double the amount of work previously done. It is usually a good deal less than double. If, for example, employees on normal day working spend 9 hours in the factory of which 1 hour is taken up by the meal break, this is likely to be replaced by double day shifts of 8 hours less half an hour for a meal in each case, the total hours of work thus being 15 hours under the shift system as against 8 hours on normal day working. The figures in the following table are typical. They are all cases of firms which have changed over from normal day working to double day-shifts, or which have both systems on roughly comparable work.

It must also be borne in mind that the hours of work on normal day working vary from week to week on account of overtime, so

that the use of the term 'double' can only be approximately correct.

If the amount set aside for depreciation were to be made to reflect as near as possible the actual value in money terms of the deterioration of plant subjected to different intensities of work, it would be a most valuable indicator of an important item in costs, but little attempt seems to be made to do this.

COMPARISON OF HOURS ON NORMAL DAY WORKING AND DOUBLE DAY-SHIFTS

	HOURS WORKED PER WEEK		
	A *Normal Day Working*	*B* *Double Day-Shifts*	$\frac{\text{Col. } B}{\text{Col. } A}$
1. Textiles (with Saturday morning shift)	45	81	1.80
2. Textiles (without Saturday working)	45	75	1.66
3. Metal Fabrication (without Saturday working)	44	75	1.70

The allowance given by the Board of Inland Revenue for depreciation of plant is (in the Board's own words) 'subject to adjustment if it appears that the wear and tear is greater or less than that which might be expected to be caused by normal use, e.g. where there is double shift working or where plant is temporarily out of ordinary use'. We have details of a firm in the cotton industry which went over to double shifts and applied for this adjustment to be operated. Its hours of work had gone up by two-thirds, but the allowance for depreciation was increased by the Inland Revenue authorities by only one-third. This firm is depreciating at $12\frac{1}{2}$ per cent now that it has the extra Revenue allowance for double shifts, but the managing director stoutly maintains that the correct figure to cover wear and tear should be 18 per cent. Yet an increase in depreciation of the same order as the increase in hours would give a figure of $15\frac{5}{8}$ per cent.

Here are some other examples showing inconsistent practice:

A firm in the Midlands changed from normal day working to double day-shifts, and this increased its hours of work by four-fifths. An increase of the same magnitude in the provision for depreciation would have raised this from 4 per cent to $7\frac{1}{5}$ per cent, but in fact they raised it to only 6 per cent.

A large firm in the textile industry depreciates at exactly double the normal rate when any machinery is used on double shifts. Since they suffer more from obsolescence than deterioration, one might

have expected them to be more concerned about the number of years since the machines were new than the number of hours' work that they have done. But we were informed that double depreciation for double shifts is the settled policy applied to all the firm's branches.

Another firm made no increase in its rate of depreciation when double day-shifts were begun, and showed a big drop in costs after the change from normal day working. When it was pointed out that these costs included depreciation which had in effect been almost halved owing to the increased production, the reply was that an increase in the depreciation rate had been considered, but it was not felt that the increased wear and tear would be sufficient to justify it. The work here was of a nature similar to some of that done by the firm previously mentioned, although it is not exactly comparable, the former firm handling a somewhat wider variety of yarn and having rather older machinery on the average. They do, however, so resemble each other in general that the different approach to depreciation effects a striking contrast in their accounts.

The impression we have gained after examining these and many other cases is that the rate of depreciation applied to equipment used on double shifts is arrived at by rule of thumb — and different cost accountants have very different thumbs!

The result, for us, is that the effect of shift working on capital costs is not easy to assess accurately; and it is almost impossible to disentangle the really fixed items of overhead costs from those which rise slightly when there is greater activity in the works. This particularly applies to office and administrative expenses, the total of which is constantly varying so that nobody is prepared to say that the salary of a certain clerk or the cost of one new typewriter is attributable to the extra office work caused by double shifts in the factory.

As far as we have been able to make out, what happens is that the manager of an industrial concern makes a shrewd approximation of the benefit which double shifts would give him on capital costs and overheads, and bearing in mind also various alternative adjustments which could be made in depreciation rates, he turns his attention to the adverse factors. If, as is most likely, he wants to expand output by doubling his labour force, he has to consider whether it is possible at all to do this in times of full employment. For operations requiring skilled men this is an almost impossible situation under present conditions, and the only men available are a few who would like to move to a factory nearer their homes, or for some similar extraneous reason. Nevertheless, labour can

sometimes be found, and once he is assured of this, the entrepreneur has to consider what it would cost.

It is at this point that generalizations break down and at which the industrialist may justifiably say that he knows his own business best. Shift workers are paid at a higher rate per hour than persons on normal day working, the difference between the two rates being called the *shift premium*. But the ways in which the premium is arrived at are so numerous that scarcely any two are alike. There may well be as many different premiums *in one factory* as there are trades, and grades of each trade, so that the aggregate effect on costs will depend on how many of each trade and grade are going to be employed on each kind of shift. There are also differences for the same trade and grade in different areas although these are not often large.

National agreements on wages for most industries contain a reference to shift premiums either in pence per hour or as a percentage of normal day-work pay, but these are varied locally by special agreements relating to piece work and bonuses and week-end overtime to compensate the workers for advantages which they would otherwise lose by going on to shifts.

Night workers have for very many years been paid at a higher rate, such as time and a fifth (as in the engineering industry), and this is often maintained in the case of alternating day and night shifts. But when double day-shifts are used, a series of complications sets in. The first is that the workers on each double day-shift have a half-hour meal break for which they are usually paid, whereas normal day workers usually have an hour for dinner and are not paid for it. Thus double day-shift workers do $7\frac{1}{2}$ hours' work for 8 hours' pay. In addition the hour's pay may be higher. This is often expressed indirectly (as it is in the cotton industry for example) by an agreement to pay the workers on double day-shifts the same weekly money as they formerly had on normal day work. In these cases the conditions of employment in the past have a direct effect on the wages today.

Another difficulty is that shift premiums fluctuate in value. If a premium is a proportion of the basic rate, it rises if the basic rate is raised. If a premium is expressed in pence per hour, its relative value, as an encouragement to work shifts, falls if there is a rise in basic wages.

In view of all these factors it is not possible to say that the shift premium for an industry is such and such a figure: one might be able to say that the premium for a labourer on double day-shifts in a certain part of the country is, say, 6 per cent. Thus in the glass container industry there are over twenty possible premiums for men alone.

Comparisons are consequently difficult but, speaking generally, it is true to say that the cotton industry double-shift premiums, at approximately 17 or 20 per cent, are among the highest, engineering having a similar rate. In rayon manufacture the premium on a man's wage is about 10 per cent for double day-shifts. In cement manufacture the various rates for day and night shifts are around 7 per cent and for double day-shifts they are lower still. The asbestos industry has rates of 15 per cent for permanent night workers, 10 per cent for three-shift workers, and 5 per cent for double day-shifts.

We may regard the shift premium as being the price required to keep the workers, once shifts have been begun. But shift work is more difficult to start than it is to run once started. A major problem is to persuade the existing employees not to leave at the time of its introduction. In order to get their co-operation it is necessary first to win over the union leaders and the senior supervisors, explaining the purpose of the proposed change, and giving careful attention to all questions and complaints. If there are women workers, these explanations have to be even more thorough, because in this case the law requires a ballot to be taken and a majority vote in favour of the change has to be obtained before double day-shifts can be introduced. Naturally a firm does not make advanced arrangements until there is a good chance of the ballot being successful.

Also it may be necessary to arrange special transport for shift workers, either in conjunction with the local authority, or privately. The canteen service has to be revised. Storage facilities for the extra output may have to be prepared, and more vehicles to carry raw materials and finished goods may be needed. In the office, the pay system will have to be reorganized; and if there are new piece-rates the personnel who check and record these will have to be instructed in their revised duties. All these preparations add to costs, and are a heavy deterrent to the introduction of shift working at all, no matter how great the ultimate gain which is anticipated. Some of these transitional problems lead to permanent additions to the administrative work of the concern: for example, the extended canteen facilities, and the special transport arrangements.

The main economic arguments for and against shifts may now be summed-up as follows:

In favour of shift working

It effects a saving on capital and overhead costs.
It enables output to be increased if required.
It enables machinery to be renewed more frequently.

Against shift working

It increases wage rates.

It adds to the administrative complexity of the organization.

It raises very difficult transitional problems, of which the greatest are: finding extra labour if output is to be increased; and, in all cases, persuading the existing employees to remain.

In an attempt to find out which of these points seem most important to the entrepreneurs themselves, we have asked a large number of firms why they are using shifts. About half of those who replied definitely to this point in a questionnaire said the reason was *to get greater output*, and the proprietors of a number of other firms, when interviewed, were found to place considerable emphasis on this aspect of shifts. Most of the others who replied to this question said they used shifts because of the high cost of modern machinery, but several of those, also, mentioned greater output as an important additional reason. No doubt most of these meant that they wanted more output with as little increase in costs as possible, but it is significant that output is nearly always mentioned.

We also asked a number of other firms why they are not on shifts. Here again, shifts were associated with output by nearly three-quarters of all firms which replied. These all said that shortage of labour was the only reason why they were not on shifts already. (We were left to infer that the trade they were doing or could get was so extensive that only this outside circumstance, beyond the possibility of influence by their management, was preventing them from considerable expansion.) Only one firm stated that it was not on shifts because its present organization was adequate to cope with the volume of business done.

Shifts are often begun at the time when new machinery is brought into use. In such cases which we have encountered they have always engaged some extra labour after the change, and since the new machinery is likely to produce more per man than the old, it is almost certain that the increase in output is greater than the increase in labour alone would appear to indicate. We have not met a single case of a firm going on to double shifts with the deliberate intention of maintaining the same output and halving its existing plant. Apart from problems of indivisibility this would seem to indicate that a change to shifts comes most easily to a firm which is expanding. This is no more than one would expect, particularly in view of the transitional problems, but the extent to which the idea of shifts is associated with the idea of increased output does suggest that shift working is looked at mainly from one point of view, and that there

are many employers who have not weighed up all the potential advantages.

This preoccupation with output rather than with cost of output goes far to explain the comparative popularity, with the managements, of day and night shifts rather than double day-shifts. In the engineering, motor and aircraft industries, which are the greatest users of shifts outside of those industries which are compelled to use them for technical reasons, there is a heavy preponderance of workers on alternating day and night shifts. Only in textiles, where the great number of women employed makes large-scale night work out of the question, are double day-shifts used in really large numbers. (In textiles they also make a wide use of day work with a short evening shift, usually consisting of married women who cannot leave their families for a whole day — a system which is also used in a few other industries, notably light assembly work: e.g. the radio industry in the London area.)

Day and night shifts enable a firm to have overtime at the end of the day shift, and a total of perhaps 18 hours' work can be done as against 15 on double day-shifts. Even on grounds of cost this may not necessarily be disadvantageous, because although night shift premiums may be high and overtime rates are also high, double day-shifts often involve high piece rates to enable workers to earn in $7\frac{1}{2}$ hours what they might otherwise have earned in 8; and paid meal breaks and overtime for the whole of Saturday morning push the costs up. It is the elasticity which is the most valued feature of day and night shifts, however, especially the opportunity to step up hours by overtime when necessary in order to complete a contract by a set time.

The proprietors will point out that day and night shifts are preferred by the men, who want to be able to earn overtime money, but this raises the whole question of the relation of monetary and social values. What is an adequate reward for a man in return for having to work all night every alternate week, or fortnight, or month, as the case may be?

Any shift work, even if not involving work all night, causes a good deal of disturbance in the normal routine of life. Workers on shifts are cut off from many recreational, educational, religious and cultural activities, which involve regular meetings at times which are usually fixed to suit normal day workers. Entertainments which occur in the late evening such as cinemas, concerts and dances, are often ruled out altogether because even when the shift worker has the evening off he has to go to bed early in order to get up in time for the early morning shift next day. Women who go out to work

often prefer double day-shifts and especially enjoy the week when they work in the afternoon and evening and are able to do their shopping in the morning, but many men and most young people dislike the week of work on the second shift. As far as night work is concerned, there is so much dislike of it that it is remarkable there has been so little organized demand for double day-shifts to replace day and night working. If there are people in the same family on different shifts, the domestic arrangements become very difficult.

Should we be justified in disturbing the basis of family life in this way, in still more cases than at present, for the sake of economic advantage? Some people have already made up their minds on this point, like the official of a large branch of an important trade union who vigorously expounded to us the view that introduction of double day-shifts is an attempt to revert to conditions of near-slavery which existed when he was a boy and which he had hoped had been abolished. The first reply to this is that the cause of the workers will not be served by letting us fall behind in the economic race, and that the best hope for us all lies in a general rise in the standard of living. To which our trade union official would answer that he considers regular and fairly short hours of work, with undisturbed rest at night, to be part of the standard of living, and what use are television sets without that?

Clearly a line must be drawn somewhere. We already have some people on day work and some on shifts. Is there any reason to suppose that the present balance between day work and shift work is so suitable for our condition that we ought to try to maintain it permanently? Industrial plant is continually becoming more complex and expensive, and we shall be imposing a burden on ourselves as compared with other countries if we do not make our plant produce as much as possible while it is still up to date. This is the price of technological progress. Even if we insist on drawing the line somewhere short of 24-hour working on social grounds, we must almost certainly draw it well beyond 8 or even 10 hours a day on economic grounds.

There seem to be many people who think we can wait for automation to come and do our work for us. They would be well advised to recall that the introduction of any new and highly productive equipment has usually been hailed as about to usher in a period of less work and more leisure; whereas, instead of producing the same amount as before in a shorter time, the new inventions have eventually been put to work for about the traditional number of hours and thus used to produce more goods than before. Man is an insatiable consumer, and given the opportunity to have more goods,

he demands them. In fact, if he insisted on having his leisure instead, it is difficult to see how the machinery would be paid for, because leisure does not repay hard cash whereas production does.

Consequently a more realistic way to face automation is to consider how the immense initial cost of automatic installations is going to be paid for. Machines may lighten our toil, but the other side of the medal may be that this reduced amount of work will have to be done at more inconvenient times.

UNIVERSITY OF SHEFFIELD

A NOTE ON BANKRUPTCY IN ROAD HAULAGE[1]

by W. M. MacLeod and A. A. Walters

In the 1920s, the railway companies, after a long period during which they had held a monopoly of inland transport, had to meet strong competition from a growing road haulage industry. In their attempt to adapt themselves to the new conditions, they were handicapped by regulations which had been imposed on them in former years because of their monopolistic position. Road hauliers had almost complete freedom of action until 1933. This freedom tended to intensify the competition between the haulier and the railway and also between one haulier and another.

The intensity of the competition was the cause of much bitterness and recrimination. In this embittered atmosphere, the small haulier was made the scapegoat for many of the ills which beset the industry. This description of him was given by C. T. Brunner in his book *The Problem of Motor Transport*, published in 1928:

'He knows nothing about costing, and seldom keeps any intelligible accounts. In order to obtain business, he relies on getting a full load from one town to another at a price below that quoted by regular haulage contractors and, if he cannot do better, often below his actual operation costs, if proper allowances were made for tyres, repairs, depreciation and interest on the capital put down to purchase his vehicle in the first place, as well as for petrol and wages. The presence of these "Pirates" in the trade *accounts for the high bankruptcy rate* (our italics).' But pirates, combining wisdom with illiteracy, paid little heed to books on economics or to the 'fair' rates of the larger hauliers.

The Conference on Rail and Road Transport in 1932 reported: 'Any individual . . . is able to purchase his vehicle on the instalment system and is often tempted to force his way in by offering rates which are completely unremunerative *and necessarily lead to bankruptcy* (our italics), which, nevertheless, does not discourage others — or perhaps even himself — from following the same course in a perpetual succession.'[2]

The supposed threat of 'bankruptcy' in the road haulage industry thus seems to have been one of the main reasons for introducing the 1933 licensing system into the industry. But no examination of the

[1] Our thanks are due to Professor Walker and Dr. Beesley for their comments and guidance.

[2] *Report* of the Conference on Rail and Road Transport, 1932, p. 32.

facts has been made and the present note is an attempt to collect and analyse statistics of bankruptcy.

Any study of the road haulage industry between the two wars must suffer from the lack of information available. After 1934, we know the number of licence holders in the public haulage system (A and B licences) and the number of vehicles they operated. Before that date, however, we know only the total number of goods vehicles on the roads, i.e. with road fund licences, and we cannot distinguish between those vehicles that carried for the public and those that carried only their own goods.

The number of goods vehicles paying road fund licences for the years 1919 to 1935 was obtained from Ministry of Transport publications. An examination of the annual reports of the Licensing Authorities for the years 1936, 1937 and 1938 showed that the public carrier owned about 30 per cent of the vehicles authorized and the private carrier 70 per cent. These percentages were used to estimate the vehicle strength of the two sections for the years 1919 to 1935. In other words, we assumed that the proportion of total goods vehicles carrying for the public was the same from 1919 to 1935.

The number of A and B (i.e. public carrier) licence holders was used as an indicator of the number of firms engaged in the haulage business. The number of businesses may have been rather less than the number of licence holders, but the difference could not have been important before 1936. During the period 1919-35, it was assumed that the average number of vehicles per licence holder was 2.2 or about the same as that in 1936. Dividing the estimated numbers of vehicles owned by public hauliers by 2.2, an estimate of the number of firms of public hauliers was finally reached.

Bankruptcies in the road haulage industry were obtained from the Board of Trade's annual reports on bankruptcy. These figures are given in the table showing the Total Failures under the Bankruptcy and Deed of Assignment Acts in Principal Trades and Occupations.[3] Bankruptcies among road hauliers are given under the heading of 'Carriers, Carmen, Carters, Lightermen, Hauliers and the like'. This category includes some trades other than road hauliers — but it excludes omnibus proprietors, owners of hackney carriages, etc. During the 1920s and perhaps also during the early 1930s, it is probable that a number of horse carters went bankrupt

[3] Before the year 1935, the statistics on the number of bankruptcies do not differentiate between Failures under the Bankruptcy Acts and those under the Deed of Assignment Acts. An Act of Bankruptcy is an act which the law deems to be evidence that the debtor is unable to meet his obligations. The execution of a Deed of Arrangement is a means whereby an insolvent debtor may provide for the liquidation of his assets and the extinguishment of his debt. No differentiation between the two types of failures will be made in this note.

because they were unable to compete with the economies of motor haulage. On the other hand, it is very doubtful if the classification 'carriers, carmen, etc.' excludes any haulier offering to carry for the public. In this note, all bankruptcies listed under the general heading are regarded as those of road hauliers. Consequently, the Board of Trade figures tend to *overestimate* the number of bankruptcies in the road haulage business. Having an estimate of the number of hauliers in the industry and knowing the number who went bankrupt, the rate of bankruptcy in the road haulage industry was then calculated.

Instead of assuming that the proportion of public haulage vehicles and the number of vehicles owned by a public haulier was constant at the 1935 figure, we may assume instead that:

(*a*) the percentage of vehicles owned by public carriers was 38 per cent in 1921 and decreased at a constant rate annually to 31 per cent in 1935,

and

(*b*) the average number of vehicles owned by a road haulier was 1.6 in 1921 and this increased at a constant annual rate to 2.2 in 1935.

These assumptions give a second series of estimates of the number of firms in public road haulage. The true growth in the number of firms in the haulage industry will, one suspects, follow more closely the pattern of the second series.

In order to find out whether the bankruptcy rate among road hauliers was unusually high or not, a comparison was made with certain distribution trades — butchers, bakers, greengrocers and fruiterers, wine and spirit merchants, and confectioner-tobacconists-newsagents. As in road haulage business, the small man with a limited amount of capital does hope to enter all these trades, with the aid of a mortgage, with some degree of success, and the very small and very large business exist side by side. But our choice of these trades was also influenced by the kind of classification adopted by the Board of Trade (before the Standard Industrial Classification was introduced in 1948) in the Annual Reports on Bankruptcy.

We have simply assumed that the number of organizations in these retail trades was constant over these years *at the 1950 Census figure*. It is likely that the rates of bankruptcy for these trades shown in the table are *under*-estimates for the seventeen interwar years, and probably, in the case of confectioner-tobacconists-newsagents and

greengrocers and fruiterers, the amount of underestimation is considerable.[4]

A comparison of the bankruptcy rate of road hauliers with the bankruptcy rate of the retail food trades does not justify the claim that bankruptcy in the road haulage industry, before the licensing of goods vehicles, was unusually high. The bankruptcy rates of the trades compared were, in many cases, two and three times higher than the rate of road haulage bankruptcy.

In the early years of the 1920s the road haulage bankruptcy rate was comparatively high. These were the first years of the new industry. These were, also, the years of the ex-Serviceman with his second-hand army lorry. It is not known what proportion of bankrupt hauliers were in this category. There were probably many — the popular legend, at least, depicts the bankrupt haulier as an ex-Serviceman who bought an old army truck with his gratuity.

PERCENTAGE BANKRUPTCIES
1921–1938

Period	*Road Hauliers*		*Butchers*	*Bakers*	*Greengrocers and Fruiterers*	*Wine and Spirits Merchants*	*Confectioners, Tobacconists, Newsagents*
	High Estimate	*Low Estimate*					
1921–1924	0.43	0.31	0.32	0.82	0.42	0.28	0.39
1925–1929	0.31	0.23	0.49	1.03	0.44	0.23	0.42
1930–1933	0.30	0.26	0.53	0.76	0.47	0.36	0.55
Rail and Road Traffic Act, 1933							
1934–1938	0.15	0.15	0.43	0.72	0.35	0.24	0.37

When examining the bankruptcy rate of road hauliers in the 1920s and the early 1930s, it should be remembered that this was a period of tremendous growth in the industry. In 1933 the vehicle strength of the industry was four times greater than it had been in 1920. An expanding industry may be expected to have a smaller bankruptcy *rate* than that of a declining industry, although resulting in, perhaps, an increasing *absolute number* of failures.

Although the accepted argument for introducing licensing was couched in terms of bankruptcies, it may be objected that only a small proportion of exits from any trade do in fact become bankrupts, and that in particular a far higher proportion of small road hauliers left the industry through being bought out by other larger hauliers than was the case in any of the retail trades. It is difficult to

[4] Consumption has expanded considerably, but the multiple shop firm has relatively not made much progress in these trades. See: J. B. Jefferys *Retail Trading in Britain*, 1850-1950, p. 257 et seq., p. 285 et seq., p. 244 et seq.

see how such an argument can be accepted for the period 1920-34 in view of the low average size of road haulage firms and the very small proportion of large firms in 1935. On the other hand, there is some evidence of the development of multiple shop firms in the retail trades — although we do not know how many small shop keepers sold out to the multiple firm and so avoided being declared bankrupt.

Part of the fall in the number of road haulage bankruptcies was brought about by the licensing of goods vehicles after 1934 because the pressure of competition in the licensed industry was less than it had been and would allow a greater margin of survival for the marginal business. A thorough examination of all those wishing to enter the industry and the granting of licences only to those who can prove they are fit to enter the ranks of respectable road hauliers appears to have been an effective means of reducing the bankruptcy rate. But the cost of this was the virtual exclusion of competition from new firms. To prevent the economic and social waste of a high bankruptcy rate by restricting entry into the industry may have been to substitute one evil for another.

To conclude that what may be called the 'bankruptcy bogey' has little foundation in fact is not to establish a case for the complete removal of the licensing system. We have merely demonstrated that one of the main reasons for introducing licences was based on rumour and impression rather than fact and figures. The rumour should be scotched before it is used in other connections.

UNIVERSITY OF BIRMINGHAM

A NOTE ON LABOUR PRODUCTIVITY IN CAPITALIST AND CO-OPERATIVE SHOP TRADING[1]

by MARGARET HALL AND JOHN KNAPP

1. IN their standard volume on *Consumers' Co-operation in Great Britain*, Carr-Saunders, Florence and Peers estimated (p. 367) that retail 'Sales per Salesman', in 1932, were higher in co-operative societies than for 'All Retailers in Great Britain' in the two important co-operative departments of grocery and drapery, but lower in the butchery and footwear departments. They recognized that any general comparison of co-operative and private trade was of limited significance: 'It must be remembered . . . what a large part the small . . . family shop plays in the total of non-co-operative . . . sales . . . The comparison really required is one between sales per salesman in the co-operative shop and in its non-co-operative rival of similar size, for instance, the chain or the department store.'

Owing to the absence of census data at the time, these authors were unable to make a refined comparison of the kind they thought appropriate. The purpose of this note is to indicate the limitations on the extent to which the census data for 1950 can be used to compare sales per person engaged in co-operative and non-co-operative retailing, allowing for differences in their scales of operation. An attempt of this kind has recently been made by Mr. C. Roberts in a stimulating note on 'Labour Productivity in Capitalist and Co-operative Shop Trading' in *The Journal of Industrial Economics* for October 1955.

2. Sales per person in a retail organization are probably related, among other things, to (*a*) the size of firm or organization and (*b*) the size of plants, or shops, which compose the organization. Both the scale of the firm and the scale of plant may, in principle, be measured in various ways, for example, by sales, net value added, persons engaged, capital employed and, in the case of chain-stores, by number of establishments. Of these, the *Census of Distribution* contains data on sales, persons engaged and number of establishments but, for various reasons detailed below, these data are far from

[1] We are indebted to the authorities in charge of the Conditional Aid Programme and to the Nuffield Foundation for making finance available for our research into distribution in Great Britain, the United States and Canada, and to the Oxford Institute of Statistics, where this project is housed, for their hospitality. We are also indebted to the Statistics Division, Board of Trade, London, for some valuable suggestions.

We owe acknowledgements to Miss Audrey Franklin and Miss Barbara Freeman for assistance in preparing our tables.

sufficient to secure exact comparability of the kind Carr-Saunders, Florence and Peers had in mind.

No straightforward comparison of sales per person can be made between private and co-operative *organizations* of any given size. The organization tables in Volume II of the *Census* (Tables 24, 25, 27 and 28) do not allocate the data on co-operative societies to different kinds of business, so that on the basis of these tables, it is possible only to compare co-operative societies of various sizes (measured by sales or number of establishments), with either all non-co-operative

TABLE I

GREAT BRITAIN, 1950: SALES PER PERSON ENGAGED (IN £s) IN CO-OPERATIVE AND PRIVATE ESTABLISHMENTS BY THE SIZE OF THE ORGANIZATION IN NUMBERS OF ESTABLISHMENTS AND BY THE AVERAGE NUMBER OF PERSONS ENGAGED PER ESTABLISHMENT*

Grocery Group		*Average number of persons per establishment*						
(Sales per person)		2-2.9	3-3.9	4-4.9	5-5.9	6-6.9	7-7.9	8-8.9
Establishments per organization	1-9	2,381					*3,130*	
	10-24			3,004		*3,666*		
	25-49				2,970	*3,513*		
	50-99				2,603	*3,523*		
	100+				2,926			*3,467*
All Establishments			2,509				*3,493*	

Clothing Group		*Average number of persons per establishment*					
(Sales per person)		2-2.9	3-3.9	4-4.9	5-5.9	6-6.9	7-7.9
Establishments per organization	1-9	*3,965*	2,103				
	10-24			*3,932*			3,479
	25-49				*3,607*	4,013	
	50-99				3,368		*3,332*
	100+					*3,249*	3,545
All Establishments			2,463		*3,501*		

Furniture Group		*Average number of persons per establishment*						
(Sales per person)		2-3.9	4-5.9	6-7.9	8-9.9	10-11.9	12-13.9	14-15.9
Establishments per organization	1-9	*4,133*	2,670					
	10-24		*5,461*			4,219		
	25-49			*4,757*	6,611			
	50+				*4,884*			4,195
All Establishments			2,959	*4,929*				

Domestic Hardware		*Average number of persons per establishment*			
(Sales per person)		1-1.9	2-2.9	3-3.9	4-4.9
Establishments per organization	1-9	*4,276*		1,911	
	10-24		*3,995*	2,531	
	25-49		2,236	*4,013*	
	50-99			*3,243*	2,479
	100+		2,605	*4,614*	
All Establishments			*4,015*	1,933	

* Sales per person in co-operative establishments are shown in italics. Persons engaged part-time are reckoned as half a full-time person.

Source: Board of Trade, *Census of Distribution and Other Services*, 1950, Vol. II, Table 8, H.M.S.O. 1954.

organizations of a similar size, whatever their trade, or with non-co-operative organizations in a particular trade, e.g. groceries. As the commodity composition of sales of co-operative societies is different both from the commodity composition of retail trade as a whole and from the commodity composition of organizations in particular kinds of business, any comparisons based on these tables would be very hard to interpret. There is, however, a table in the *Census* which makes it possible to compare sales per person in co-operative and non-co-operative *establishments* in particular kinds of business.[2]

Tables I and II show the result of this comparison in a summary form for the four trades included in Mr. Roberts's table. Our tables differ from his in showing sales per person engaged by average size of establishment, as well as by size of organization measured by number of establishments. It should be noted that a considerable amount of dispersion must be expected to underlie the figures which we have calculated for average size of establishment.

There is a serious source of non-comparability which must be borne in mind when looking at these tables. In each kind of business the apparent similarity of scale of operation, as measured by establishment-size of organization, is misleading. For while, in the case of non-co-operative trading, the number of establishments per organization is, in each trade, a fairly good indication of the number of shops *in that trade* which is controlled by the organizations to which establishments belong,[3] this is certainly not the case in regard to establishments belonging to co-operative societies.

As can be seen from Table III, the average co-operative society has, whatever its size, less than half of its establishments in the kind of business group which is most important in co-operative societies, namely the grocery trade. In all other trades, (of which only those discussed by Mr. Roberts are shown separately in Table III), the average society has only a very small proportion of the total number of its establishments in the trade concerned. This means that the average number of co-operative establishments per society in the clothing, furniture and hardware trades does not indicate even

[2] Table 8 of Volume II of the *Census*. This is the table which underlies the figures shown by Mr. Roberts in the first and fourth lines of his table. The other lines in his table are based partly on Table 27 in the *Census* and partly on unpublished material. Owing to technical difficulties, these latter figures must be considered subject to large margins of error and we shall not consider them in the remainder of this article.

[3] When an organization as a whole belongs to one class of business but has establishments which are classified to other kinds of businesses, the latter are allocated to these business groups in the establishment tables of the census but, in the tables of the census which deal with organizations, *all* establishments are classified as belonging to the kind of business group which is proper to the organization as a whole. It may be noted that, in contrast to the British practice, the United States *Census of Business* measures the establishment-size of chains so as to show numbers of shops belonging to firms in each kind of business separately.

approximately the total number of establishments per organization. In other words, the figures in Tables I and II, reading along the horizontal rows, are not comparable. Yet, this is the only comparison provided by Mr. Roberts's table.

TABLE II

GREAT BRITAIN, 1950: SALES PER PERSON ENGAGED (IN £s) IN CO-OPERATIVE AND PRIVATE ESTABLISHMENTS BY THE SIZE OF THE ORGANIZATION IN NUMBERS OF ESTABLISHMENTS AND BY AVERAGE SALES PER ESTABLISHMENT*

Grocery Group (Sales per person)		5,000-10,000	10,000-15,000	*Average sales per establishment* 15,000-20,000	20,000-25,000	25,000-30,000	30,000-35,000
Establishments per organization	1-9	2,381			*3,130*		
	10-24		3,004		*3,666*		
	25-49			2,970	*3,513*		
	50-99			2,603	*3,523*		
	100+			2,926			*3,467*
All Establishments		2,509				*3,493*	

Clothing Group (Sales per person)		5,000-10,000	10,000-15,000	*Average sales per establishment* 15,000-20,000	20,000-25,000	25,000-30,000
Establishments per organization	1-9	2,103	*3,965*			
	10-24			*3,932*		3,479
	25-49			*3,607*		4,013
	50-99			3,368	*3,332*	
	100+				*3,249*	3,545
All Establishments		2,463		*3,501*		

Furniture Group (Sales per person)		10,000-20,000	20,000-30,000	*Aver. ge sales per establishment* 30,000-40,000	40,000-50,000	50,000-60,000	60,000-70,000
Establishments per organization	1-9	2,670					
		4,133					
	10-24		*5,461*		4,219		
	25-49		*4,757*				6,611
	50+				*4,884*		4,195
All Establishments		2,959		*4,929*			

Domestic Hardware (Sales per person)		5,000-7,500	7,500-10,000	*Average sales per establishment* 10,000-12,500	12,500-15,000
Establishments per organization	1-9	1,911			
		4,276			
	10-24		2,531	*3,995*	
	25-49	2,236			*4,013*
	50-99			2,479	
				3,243	
	100+	2,605			*4,614*
All Establishments		1,933		*4,015*	

* Sales per person in co-operative establishments are shown in italics. Persons engaged part-time are reckoned as half a full-time person.

Source: Board of Trade, *Census of Distribution and Other Services*: 1950, Vol. II, Table 8, H.M.S.O. 1954.

The vertical columns in Tables I and II show sales per person for given sizes of establishment. Co-operative and private establishments often belong to altogether different size groups whether measured by sales or by the number of persons they employ. As a result, out of

TABLE III

THE STRUCTURE OF CO-OPERATIVE RETAIL SHOP TRADING, BY SIZE OF SOCIETY, IN SELECTED KINDS OF BUSINESS

Trade	*Establishment-size of societies* 1-9	10-24	25-49	50-99	100 & over	Total
	Average number of shops per society					
Grocery	2.0	6.8	14.2	27.7	71.5	11.1
Clothing	0.6	2.2	4.0	6.1	15.4	2.8
Furniture	0.05	0.4	0.9	1.1	2.0	0.5
Domestic Hardware	0.05	0.3	0.3	0.5	1.2	0.3
All Other Trades	1.5	6.0	13.1	30.1	93.4	25.0
All Trades	4.2	15.7	32.5	65.5	183.5	39.7

Source: Board of Trade, *Census of Distribution and Other Services*, Vol. II, Table 8 and Table 25.

43 columns in three Tables, there are only 12 where a direct comparison of sales per person in the two sectors can be made at a glance by reading the columns downwards.

When, however, the data in these tables are arranged in the form of scatter-diagrams showing sales per person *against size of establishment* it is readily seen that, in private trading, sales per person tend to increase with the average size of establishment, whether size of establishment is measured by sales or by number of persons engaged, in all four of our trades.[4] This supports the idea that sales per person are in fact related to size of establishment.[5] When this relationship is taken into account, the proposition put forward by Mr. Roberts that sales per person are generally higher in co-operative shops, size for size, ceases to hold, except in the domestic hardware trade. In the furniture trade, it holds only when size of establishment is measured by sales, but not when size is measured by persons employed. In the

[4] Similar scatter-diagrams in respect of 13 minor kind of business groups, accounting for 88 per cent of total sales of co-operative retail establishments, show sales per person increasing with average size of establishment in private retailing in 11 out of 13 trades when size is measured by sales per establishment, and in 8 out of 13 trades when size is measured by persons engaged per establishment. The minor kind of business groups we have examined are: grocers, dairymen, butchers, tobacconists, boots and shoes, men's wear, women's outfitters, men's and women's wear, domestic hardware, dispensing chemists, domestic furniture, department stores and coal.

[5] For some recent discussions of this, see: S. Pollard and J. D. Hughes: 'Retailing Costs: Some Comments on the Census of Distribution, 1950', *Oxford Economic Papers*, New Series, Vol. I, No. 1, February 1955, *passim*; Margaret Hall and John Knapp: 'Numbers of Shops and Productivity in Retail Distribution in Great Britain, the United States and Canada,' *Economic Journal*, Vol. LXV, March 1955, p. 79; and Margaret Hall and John Knapp: 'Gross Margins and Efficiency Measurement in Retail Trade', *Oxford Economic Papers*, New Series, Vol. 7, No. 3, October 1955, p. 325.

grocery trade, the higher sales per person in co-operative trade appear merely to be in conformity with the larger size of co-operative establishments, in the sense that the superiority of co-operative sales per person is no greater than is indicated by the average relationship of sales per person to size of establishment in private trade. In the clothing trade, co-operative sales per person are higher for small sizes of establishment, but are lower than in private trade, where the average size of establishment is large.

3. The comparability of sales per person in co-operative and private trade is subject to two further qualifications of some importance. First, the data on persons engaged in Table 8 of Vol. II of the *Census* excludes persons employed in central offices and warehouses. Such persons accounted for 19 per cent of total co-operative employment in retail trade, but only for 3 per cent in private retail trade.[6] Consequently, sales per person are overstated in co-operative trade relatively to private trade. (This factor accounts for 20-40 per cent of the average difference in sales per person in the four trades for which figures are given in Tables I and II.) Secondly, the commodity composition of sales in co-operative establishments is, in some kinds of business, very different from what it is in private trade, and this can have a marked effect on the figures for sales per person.[7]

4. Thus, so far as the data available in the *Census* enable us to take account of differences in the scale of operation, it does not seem possible to give a simple answer to the question of whether sales per person are higher in co-operative than in private trading. Nevertheless, detailed comparisons made possible by the Census data reveal a recurrent pattern. When sales are plotted against size of establishment in 12 minor kind of business groups,[8] it is found in 7 cases (on either of our two measures of establishment-size), that co-operative sales per person tend to be highest relatively to private sales per

[6] In the private grocery trade, this figure was 3.9 per cent. Details of employment in central offices and warehouses are given in Table 2 of Vol. II of the *Census*.

[7] Thus, while in retail trade as a whole, 69 per cent of total sales of cigarettes, tobacco and smokers' requisites is sold by the confectioners, tobacconists, newsagents group, in co-operative trade the corresponding percentage is less than 5 per cent. The great bulk of the sales of tobacco, etc., sold by co-operative societies is sold by grocery establishments. (Indeed, co-operative statistics show sales of tobacco as sales of the grocery department). These sales may account for as much as 20 per cent of the sales of co-operative grocery shops. By contrast only 8.5 of the sales of private grocery organizations is accounted for by sales of tobacco, etc., and this figure, being based on organization statistics, may include sizeable sales through tobacconists' shops owned by grocery organizations. The bearing of this difference in commodity composition of sales on differences in sales per person can be seen when it is remembered that sales per person in tobacconists' shops are about 2½ times what they are in the grocery trade.

[8] For a list of these kind of business groups, see p. 72, footnote 4, above. Department stores have had to be omitted from this analysis as the *Census* contains no breakdown of co-operative department stores by number of establishments of the co-operative societies to which they belong.

person for smaller sizes of establishment, and least so for larger sizes of establishment. This generally reflects the fact that while sales per person tend to increase with size of establishment in private trade, this relationship is generally absent in co-operative trading, where the tendency is for sales per person to remain constant, or to decline as the size of establishment increases. [9, 10] It seems that attempts at explaining comparative figures of sales per person in co-operative and private trading might profitably be concentrated on the analysis of this pattern.

5. Another remarkable pattern which emerges, as a by-product, from an analysis of co-operative outlets by size of society is that sales through non-food establishments as a percentage of total sales do not vary much with size of society, the percentage ranging between the limits: 22-29 per cent. This clearly invites further investigation.

[9] Sales per person are constant or decline with increasing size of establishment in 9 out of 12 trades when size is measured by persons engaged, and in 6 out of 12 trades when size is measured by sales.

[10] There is no reason to believe that the pattern described in the text would be significantly affected if it were possible to make allowance for the influences of (i) differences in the importance of employment in central offices and warehouses, and (ii) differences in the composition of sales, by size of society.

OXFORD

A COMMENT

by P. Sargant Florence

Hall and Knapp point first to the fact that whereas a non-co-operative chain specializes in one kind of business and usually sells the same sort of goods in all its shops, a co-operative society has shops specializing in different kinds of business; size of organization measured by number of shops means something different, therefore, in the co-operative and non-co-operative regime. This is true; but it is all the more surprising, under these circumstances, that co-operative sales per salesman come out higher. As Roberts's table shows, the larger non-co-operative organization, measured by by number of shops, tends, up to a point to have the higher sales per salesman; e.g. in grocery and hardware up to twenty-four shops, in clothing and furniture up to the point of forty-nine shops. There appears an advantage, therefore in fairly large *specialized* chains which, as Hall and Knapp state, the co-operatives do not possess to the same degree.

Hall and Knapp's second point is more telling, namely the higher proportion of co-operative employees in wholesale or central premises not counted as salesmen. 'Such persons', they write, 'accounted for 19 per cent of total co-operative employment in retail trade, but only for 3 per cent in private retail trade.' Total employment is, however, not the relevant denominator, since few organizations with nine or less shops have much in the way of 'wholesaling or central premises.' If we confine the denominator of the ratio to the number of *persons engaged in retail organizations with ten or more shops*, the difference in the co-operative and non-co-operative ratio is not 19 to 3 but 25 to 19. The calculations based on *Census* data Vol. II, Table 8 and Vol. III, Table 11 is as follows:

	(a) *Full time in Wholesale and Central Premises (men and women added)*	(b) *Total full time in retail organizations with ten or more shops*	*Ratio a/b*
Non-co-operative:	70,157	370,565	19%
Co-operatives:	41,921	167,864	25%

Finally, there is the possibly disturbing effect upon Roberts's thesis of the factor of economies of scale in shop operation, measured by employees per shop. Hall and Knapp's tables with italics for co-operatives are elegant pieces of three dimensional composite presentation for which the authors deserve congratulation, but they only confirm the superior sales per salesman in co-operative trading

(except for the clothing group), while providing some partial explanation for this superiority, at least in grocery trading. In grocery, co-operative societies apparently manage to get their much higher average sales per establishment partly by having establishments larger in terms of salesmen. I say partly, because the co-operative superiority in sales per salesman is far greater than can be accounted for by comparing shop sizes in the grocery trade generally. The ratio, for instance, between the productivity per salesman of a four-man and a five- or six-man grocery is not of the order of £3,004 to £3,666 as in Hall and Knapp's composite table but by the plain *Census* (Vol. II, Table 11, p. 154) only that of £3,050 to £3,100. In short when Hall and Knapp tell us that in private trading 'sales per person tend to increase with the average size of establishment' they should have added 'but not much'. The tendency is hardly strong enough to account for all of the large co-operative differential. In grocery, indeed, the tendency, to go by Hall and Knapp's non-italicized, non-co-operative figures, does not extend beyond the shop of 4 to 4.9 persons or £15,000 of sales.

The major explanation of the much higher co-operative sales per salesman still appears to me that put forward by Mr. Roberts, namely the co-operatives' reliance 'on the continued regularity of their existing trade' by 'the avoidance of intense shopping peaks, and thus eliminating the need of additional salesmen who would be partially idle at off-peak hours.

UNIVERSITY OF BIRMINGHAM

A REPLY

by MARGARET HALL AND JOHN KNAPP

1. WE welcome this opportunity of carrying the analysis further. To compare sales per person in private and co-operative organizations, we need to define the determinants of sales per person. A partial theory implicit in Mr. Roberts's note is that sales per person depend on the total number of establishments in an organization, whereas Professor Florence, taking up a point in our article, thinks that they depend on the number of its shops in a particular kind of business. The *modus operandi* of the influence of size of organization on sales per person is not stated explicitly either by Mr. Roberts or Professor Florence. On consideration, we prefer Mr. Roberts's implicit theory to Professor Florence's. Shops belonging to chains are likely to have higher sales per person than other outlets of comparable size mainly because they are more centrally sited and concentrate on faster moving goods. Both these advantages are available to co-operative societies even where their specialist chain size is smaller. We cannot therefore agree with Professor Florence that Mr. Roberts's figures understate comparative labour-productivity in co-operatives.

We ourselves did not sufficiently emphasize the probable effect of size of organization as against size of establishment. We should have relied more heavily on our two-way tables. These tables do not yield clear-cut evidence of the *independent* influence, either of size of organization or of size of establishment, when the figures for co-operatives and the private sector are considered separately. The influence of size of organization is not in evidence where comparisons can be made for a given size of establishment. Sales per person do increase quite sharply at first as the size of organization increases, but the independent influence of size of organization cannot be identified over this range, since the size of establishments also increases. (Professor Florence's evidence for the influence of specialist chain size is marred by this fact.) Similarly, one cannot isolate the effect of size of establishment with these tables. This is a point on which we were unclear in our first article. Consider the case we made a good deal of, namely, the grocery trade. Here the co-operative shops are consistently bigger. Thus, in attempting any comparison between the sectors for a given establishment-size, one has either to extrapolate what relationship can be gleaned from our tables concerning the

[1] In writing this note, we have benefited from discussion with Mr. C. B. Winsten of the Oxford Institute of Statistics.

joint effects of establishment and organization size, or find other evidence. The non-co-operative 'surface' becomes rather flat for the larger sizes of establishment and organization, as Professor Florence hints, so that on this basis the co-operative figures show an apparent superiority. However, this neglects an important source of non-comparability, namely, the influence of tobacco sales by grocers.[1]

Professor Florence cites other evidence on the basis of data taken from *Census* Table 11. That table classifies by size of establishment as measured by number of persons engaged, but this again fails to measure the independent influence of establishment-size.

Professor Florence is concerned at the different results obtained from Tables 8 and 11, but such differences may well occur as a result of the different averaging processes because of the scatter. For example, for small sizes of establishment, figures for sales per person derived from Table 8 may be expected to be lower than those shown in Table 11, because the latter includes the small establishments of the better located chains and co-operatives while, for larger establishments, a reverse effect will occur. To choose the most appropriate averaging process requires more elaborate theory and more information than we possess. The two averaging processes based on Table 8 distinguish between size of organization and size of establishment when presented in two-way tables. They may, therefore, be regarded as a provisional best.

2. A general view of comparative sales per person in co-operative and non-co-operative retailing is afforded by the figures in Table IV.[2] This takes account of two important differences in the character of co-operative and private trading, namely, (i) the much higher degree of concentration of co-operative business in large organizations and, (ii) the tendency of co-operative shops to channel most of their tobacco sales through grocery shops.

Columns 2 and 5 may be taken to represent extreme estimates of comparative sales per person in co-operative and private trade. In accordance with our argument in para 1 above, we consider the figures calculated on the basis of 'Roberts's assumption' to be nearer the mark. Clearly, the influence of commodity composition and of the degree of concentration of sales, is considerable. The overall picture does not suggest that co-operative sales per person are generally higher. The failure of the table to take account of the influence

[1] See para. 2 below.

[2] This table classifies by organization size alone. Non-co-operative sales per person are calculated for comparison with the co-operatives by estimating the commodity composition of co-operative sales, and by applying their pattern of sales to non-co-operative firms. We do this on two systems of weighting, and on two assumptions concerning the appropriate non-co-operative chain stores.

of size of establishment merely fortifies this conclusion since co-operative shops are generally larger and there are good reasons for believing in the existence of economies of scale of establishment.[4]

TABLE IV

SALES PER PERSON IN CAPITALIST AND CO-OPERATIVE SHOP TRADING BY SIZE OF ORGANIZATION WITH COMMODITY COMPOSITION STANDARDIZED(a)

Establishments per organization	*Sales/Person*(b) *in Co-operative Societies* (£s)	*Index*	*Capitalist sales per person*(b) *'Roberts's assumption'*(c) *(With adjustment for tobacco sales)*	*(Without adjustment for tobacco sales)*	*'Florence's assumption'*(d) *(With adjustment for tobacco sales)*	*(Without adjustment for tobacco sales)*
		Col. 1	*Col.* 2	*Col.* 3	*Col.* 4	*Col.* 5
			(Indices on base: Co-operative sales/person = 100)			
1-9	2973	100	85	76	87	80
10-24	3486	100	107	89	78	72
25-49	3341	100	116	95	83	78
50-99	3257	100	110	89	87	81
100+	3486	100	103	86	84	77
TOTAL	3256	100	111	91	87	81

Source: Board of Trade, *Census of Distribution and Other Services*, Vol. II, Table 8, Table 23 and and Table 24.

(a) Capitalist sales per person are weighted by the relative importance of co-operative sales in different kinds of business in cols. 3 and 5 and in columns 2 and 4 by the same weights adjusted by allocating estimated tobacco sales of grocers to tobacconists.

(b) Two part-time persons are reckoned as equal to one full-time worker.

(c) Capitalist sales per person as given in the *Census* for non-co-operative organizations in each specialist kind of business in respect of the size-groups 1-9, 10-24, 25-49, 50-99, 100+ respectively, weighted in the two ways described in footnote (a).

(d) Capitalist sales per person as given in the *Census* for non-co-operative organizations in each specialist kind of business in respect of the size groups indicated by the average number of *specialist* establishments per society found in co-operative organizations of the size-groups 1-9, 10-24, 25-49, 50-99, 100+ respectively, weighted in the two ways described in footnote (a) (see Table III of our first note, p. 72).

[4] We accept Professor Florence's suggestion about the allocation of central office and warehouse employees to the larger organizations. But if the co-operative personnel consisted largely of clerks accounting the 'divi', while the private personnel were largely engaged in performing essentially wholesaling functions, Mr. Roberts's figures would still be biased in favour of the co-operatives.

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THE REWARD FOR RISK-BEARING BY SHAREHOLDERS IN LARGE COMPANIES

by P. Sargant Florence

I

This article is part of a larger study[1] and to justify its detailed character and place the detail in proper perspective the background may be sketched briefly in the form of three propositions:

(1) That with increasing mechanization and application of science, industry requires more capital for every worker employed.

(2) That partly in consequence, and short of State-ownership, the public Joint-Stock company, able to amass large capital, is likely to increase in importance.

(3) That with no evidence of lessened risks, the role of the risk-bearing shareholder in the company becomes ever more important.

At first sight of this last proposition many readers may cry out that the shareholder is in fact not playing a role at all, and that the main source of funds for investment comes from ploughing back profits — a decision of the Board of Directors — not from new money subscribed by shareholders. Undoubtedly, the issue of new shares to the public in exchange for cash plays but a minor part in the routine of modern company finance[2] and the normal procedure in industrial development is for the directors to allocate high and often seemingly arbitrary[3] proportions of the profit to reserves, without much protest from shareholders.

Role is a word much beloved by sociologists and, sociologically speaking, the shareholder certainly plays no active role. But the economist must reply that the directors' decision to plough back profits into the company, owned as it is by the shareholders, makes each shareholder own more risk-capital. In fact, part of the risk taken on by the shareholder in any company is that the directors will further implicate him in the company instead of giving him

[1] Completed by G. M. Lawrence, Irene Bowyer and myself under a grant to the University of Birmingham from funds made available under the Conditional Aid Scheme for the use of Counterpart Funds derived from the U.S. Economic Aid.

[2] Among the 81 very large English industrial and commercial companies of over £3M nominal capital in 1951, 31 had in the previous fifteen years made no change at all in their issued capital and a further 15 not more than a 10 per cent change. Of the remaining minority, a large proportion had increased their nominal capital by bonus shares to their existing shareholders (i.e. by 'share splitting'), without calling for any cash payment.

[3] Arbitrary in the sense that the ratio of actual dividend paid to net earnings for dividend varies widely as between different companies – a variation that cannot be accounted for by the varying technical needs of different industries for development, or by the principle of fair shares between company reserves and shareholder. Part of our survey was to find this ratio during the years 1948-51 for each of the large industrial and commercial companies. It is hoped to publish results soon.

dividends in the form of cash with which to do as he likes. Thus, 'ploughing back', though it is the main method of raising capital today, as in most past periods of capitalism, by no means makes the study of the feelings, incentives and aversions of the ordinary shareholder unnecessary. The ordinary shareholder even if he does not often *take* risks in the sense of making decisions about what equipment to invest in or whether to issue new shares still *bears* the risks. And he still can make such decisions as whether to sell out of his company and/or whether to buy up some new issue or some other company's old shares.

Decision-making in the process of investment requires perhaps further and more systematic analysis. If we are to discover whether rewards are sufficient incentives for encouraging the necessary risks to be borne we must be clear to whom it is that these incentives are to be addressed. Fully analysed the process of investing funds in industry involves at least three components: collecting the funds (i.e. saving); putting the funds at the disposal of industry (i.e. financing); and laying out the disposable funds in physical equipment (i.e. investment as economists now seem to use the word).

In the procedure of reinvesting profit, all three components are (actively) controlled by one set of persons — the top government of the firm or company — who decide how much of the profit to save (i.e. not to distribute as dividends); how to allocate the residual reserve between liquid and fixed assets; and of what precise physical objects the fixed assets are to be composed.

Under the system of investment to be discussed here, the persons actually making the decisions, the savers, financiers and 'physical' investors are different sets of people, and, indeed, often different *sorts* of people. Of these three sets of people involved in this process of obtaining risk-capital our present inquiry is interested mainly in the savers. They are persons or institutions originally outside the company who become involved by sale to them of the company's shares in exchange for their savings, their shares in other companies and/or liquid resources generally. Once they have become shareholders, these outside or private investors are always at liberty to sell these shares to other investors. Some of them may do so almost immediately; and indeed, may have only bought shares in one company in the hopes of selling out soon at a profit. Other investors, and in the case of industrial shares, undoubtedly the great majority, intend to hold on for a considerable period.

As a reasonable estimate we have taken the actual period of holding to be fifteen years. Those who would estimate a longer period must bear in mind that though an investor may have expected

to stay in longer, death may overtake him and death duties his heirs. Those who would estimate a shorter period must remember the mass of English industrial investments held in the names of passive shareholders content to draw dividends year after year. The policy of stability of dividend to which so many Boards of Directors adhere in spite of fluctuating and variable profits, has encouraged and is encouraging this passivity. It would be a useful line of research to replace a mere 'reasonable' estimate by facts about the average length of tenure of holdings of industrial shares; meanwhile we may take fifteen years as at least a plausible period of tenure and look into the results of holding shares in large English industrial companies over the fifteen years 1936-51.

II

The public joint stock companies that were surveyed were *all* the English entries[4] in the Industrial and Commercial section of the *Stock Exchange Year Book* with nominal issued capital of a million pounds or more in 1951, subdivided into 'very large' companies with three million pounds nominal issued capital or more, and 'medium large' companies with less; and a stratified sample as representative as possible of 'smaller large' companies with issued capital between £200,000 and £1,000,000. 'Smaller large' may sound silly, but it must be stressed that a company with a quarter of a million nominal capital still ranks as large. A similar survey was made of companies in the brewery section of the *Year Book*; the results appear in Section III and Table 4 in order to compare industries.

The points in which we are interested are the risks involved to the investor, that is the purchaser of shares in these companies who stayed in fifteen years; and the payment this investor received as a compensation for his risk bearing. The question whether compensation was adequate for the required supply of risk-capital will be taken up in Section V.

Since the risks are financial, both the risks themselves and the payment for risks take the same form, namely the difference between purchase price in 1936 and sale price in 1951 of the shares themselves; and the payment of dividends meanwhile upon these shares. Since the great majority of shareholders do not reinvest their dividends in the same shares, no cumulative accretion is allowed for. These particulars were obtainable for nearly all the companies we surveyed.

[4] Excluding (the relatively few) Scotch companies with the list of their shareholders filed in Edinburgh, not London, and avoiding duplication by excluding subsidiaries of large companies already surveyed.

TABLE I

DISTRIBUTION OF 304 LARGE INDUSTRIAL AND COMMERCIAL COMPANIES BY THEIR EQUITY SHAREHOLDERS' TOTAL INVESTMENT GAIN 1936-51

Extent of Gain	*Very large companies*	*Medium large companies*	*Sample of smaller large companies*	*All large companies*
−25% to −100%	1	3**	1	5
0 to −24.9%	1	4	4	9
0–24.9%	3	4	6	13
25–49.9%	14	15	7	36
50–74.9%	16	6	10	32
75–99.9%	11	16	6	33
100–149.9%	13	26	13	52
150–199.9%	5	16	11	32
200–299.9%	8	15	11	34
300–339.9%	6	10	8	24
400–499.9%	2	8	5	15
500%+	1	11	7	19
Total	81	134	89	304
Arithmetic Mean Gain	+129%	+188%	+201%	+180%
Coefficient of Variation derived from Standard Deviation*	53%	62%	81%	64%
Lowest Gain:	−49%	−82%	−49%	−82%
10% gained less than:	+32	+31	+19	+27
90% gained less than:	+298	+516	+467	+411
Highest Gain:	+542	+780	+1535	+1535

* Based on index numbers 1936 = 100
** −82%, −55%, −44%.

Table I is able to give the total investment gain (i.e. by the price changes of the capital invested originally and by subsequent bonus issues and by dividend on both) for 304 companies: 81 very large; 134 medium large; and 89 smaller large. This gain is expressed as the percentage added by September 1951 to a stake invested in September 1936. In short, Table I shows the distribution of the total gains obtained in 1951 by a shareholder who had in 1936 invested £100 in each of the 304 companies.[5] The risk consists

[5] In choosing particular years as end points for the period of survey it is impossible, of course, to know beforehand whether the events of later years will not make the choice unrepresentative. Our survey begun in 1936 was organized between 1951 and 1953 by which date the end point had to be finally settled for the long and complicated calculations involved. Stock exchange prices of ordinary industrial shares fell considerably in 1952, and failed to rise to the 1951 level by 1953 – both 1936 and 1951 were, in fact, peak years. Thus, if 1952 or 1953 had been taken as the end point rather than 1951 the reward to the investor, as far as capital gain – the chief factor, as we shall see – was concerned, would have been lower. On the other hand, after 1953 stock exchange prices rose steeply to July 1955 and though there has subsequently been a substantial fall the annual rate of reward over the period 1936-56 would be somewhat higher than over the period 1936-51.

not only in a low average for the whole distribution of gains, but in a wide deviation in the gains of item companies from this average. This deviation marks the risk arising from the uncertainty of any given average and should be measured independently of the magnitude of the average gain. Deviations are likely to be wide merely because the average is high, or to be narrow because the average is low; but what we want to measure is the width of the deviations *relative* to the height of the average.

There are a number of ways of measuring averages and relative deviations,[6] but for the sake of simplicity Table I gives for each size and all sizes only the measure that is most commonly used: the arithmetic mean and the *coefficient of variation.*[7]

The pattern of Table I referring to total investment gain is repeated in Tables II and III for dividend gain and capital gain separately.

At least five sets of conclusions may be drawn from Tables I, II and III. Three (numbered 1-3) concern total gains; one (4) contrasts dividend and capital gains; and another (5) concerns the different effect of different sizes of company:

1. The average total gain between 1936 and 1951 from changes in Stock Exchange prices and the dividends of all the large companies (very large, medium and smaller) was +180 per cent.[8]

2. The variability or dispersion of the total gain between the 304 large companies is wide when compared with other variable phenomena in economic affairs or in nature. The total range varied from −82 per cent to +1535 per cent, and the Pearsonian 'coefficients of variation' (formed on the basis of index numbers by the standard deviation divided by the arithmetic mean)[7] are for the three sizes 53 per cent, 62 per cent and 81 per cent. For men's heights Pearson and others have shown that the coefficient of variation is only 3 to 4 per cent. For English noon temperatures week by week throughout five years (taken at Chester), the coefficient of variation was 18.6 per cent.[9] The variation in total company gains was thus for every size-group much wider even than the fluctuations over the year of the English weather!

3. Wide variation in gain implies that though average gain appears substantial, some individual gains may be very low, and

[6] See Appendix at the close of this article.

[7] This coefficient, devised by Karl Pearson, divides the standard deviation by the arithmetic mean average. The standard deviation is the square root of the average of the squares of the item deviations from the average. It is described and illustrated in all statistical manuals. In calculating the coefficient negative values must be avoided. The item gains (and losses) are therefore expressed as index numbers with 1936 values as the base equated to 100.

[8] This is the arithmetic mean gain; for the median see Appendix.

[9] D. C. Jones, *A First Course in Statistics*, 1927, pp. 51, 65.

may even be negative, that is, may be losses. It has been argued that it is mainly the fear of loss, even though the chance of a loss is slight, which affects men in investing their money and which outweighs high chances of gain. If this is so, particular importance attaches to the very lowest gain (or loss). In fact, Tables I and III

TABLE II

DISTRIBUTION OF 304 LARGE INDUSTRIAL AND COMMERCIAL COMPANIES BY THEIR EQUITY SHAREHOLDERS' DIVIDEND GAIN 1936-51

Extent of Gain	*Very large companies*	*Medium large companies*	*Sample of smaller large companies*	*All large companies*
Less than 0%	0	0	0	0
0–24·9%	1	4	2	7
25–49·9%	14	4	11	29
50–74·9%	34	33	18	85
75–99·9%	14	36	18	68
100–149·9%	11	28	18	57
150–199·9%	6	21	12	39
200–299·9%	1	7	8	16
300–399·9%	0	1	1	2
400–499·9%	0	0	1	1
500%+	0	0	0	0
Total	81	134	89	304
Arithmetic mean gain	+79%	+103%	+108%	+100%
Coefficients of Variation derived from Standard Deviation*	21%	28%	35%	29%
Lowest Gain:	0	0	0	0
10% gained less than:	+43%	+53%	+38%	+44%
90% gained less than:	+125	+190	+210	+172
Highest gain:	+223	+389	+429	+429

* Based on index numbers, 1936=100.

show large total capital losses for at least one company of every size. There can, of course, be no loss by dividend. One-tenth of all the companies are shown to have made a total gain of 27 per cent or less. Yet 37½ per cent is the gain to be made in the course of fifteen years in post-office savings, doubly secure — as to income and capital. When all brewery were added to all industrial and commercial medium and very large companies (i.e. all with over a million pounds capital), it was found that exactly one-sixth had a total gain below that of the secure post office savings.

4. These losses or relatively low gains are mainly due to capital losses or very low capital gains, shown in Table III. Investors in over a quarter of all the companies suffered an absolute loss on capital account, and investors in a tenth of the companies suffered as can be seen, an absolute capital loss of 27 per cent or more.

TABLE III

DISTRIBUTION OF 304 LARGE INDUSTRIAL AND COMMERCIAL COMPANIES BY THEIR EQUITY SHAREHOLDERS' CAPITAL GAIN 1936-51

Extent of Gain	*Very large companies*	*Medium large companies*	*Sample of smaller large companies*	*All large companies*
−25% to −100%	6	14	12	32
0 to −24.9%	21	16	14	51
0–24.9%	16	21	11	48
25–49.9%	9	19	6	34
50–74.9%	10	13	14	37
75–99.9%	5	12	4	21
100–149.9%	2	14	8	24
150–199.9%	5	6	7	18
200–299.9%	4	8	5	17
300–399.9%	2	4	4	10
400–499.9%	1	3	2	6
500%+	0	4	2	6
Total	81	134	89	304
Arithmetic mean	+50%	+85%	+93%	+80%
Coefficients of Variation derived from Standard Deviation*	61%	72%	96%	80%
Lowest Gain:	−52%	−86%	−74%	−86%
10% gained less than:	−23	−23	−34	−27
90% gained less than:	+189	+345	+287	+244
Highest gain:	+438	+588	+1106	+1106

* Based on index numbers, 1936=100.

Comparing average capital with dividend gain of the large companies in Tables II and III it appears that, over the fifteen years, capital gains were less on the average than dividend gains and that they were more dispersed. The arithmetic mean of capital gains of all sizes of company was 80 per cent as against 100 per cent for dividend gain. But capital gains were more widely dispersed and the more numerous losses and very low gains were clearly counterbalanced by some capital gains much higher than any dividend gains. A tenth of the capital gains were +244 per cent or over, but a tenth of the dividend gains only +172 per cent or over.

Comparing Tables II and III points, in fact, to the relative stability of dividends. The coefficients of variation they give are very low for the dividend gains when compared with those for the capital gains.

COEFFICIENTS OF VARIATION OF INDICES OF DIVIDEND AND CAPITAL GAINS 1936-51

Size of company:	*Very large*	*Medium large*	*Smaller large*	*All sizes*
Dividend Gain:	22%	28%	35%	29%
Capital Gain:	60%	72%	96%	80%

If we compare the 'bulk' of companies excluding the top and bottom tenth of gainers, the same tale is told. For all sizes, eight-tenths of dividend gains lie between +44 and +172 per cent, eight-tenths of capital gains between the much wider limits of −27 and +244 per cent. And the larger the company the more stable the gains. In dividend gain, eight-tenths of the *very large* companies varied between +43 per cent and +125 per cent, while the smaller large companies varied between +38 per cent and +210 per cent. In capital gain the contrast was still greater: eight-tenths of the very large companies varied between −23 per cent and +189 per cent, eight-tenths of the smaller companies between −34 per cent and +287 per cent.

Conclusions about the average and the shape of the risk to capital values arising from investment over a *given* time in *different* companies may now be contrasted with the level and shape of the risks to capital gains arising from investment in large companies generally, from time to time. This 'time risk' is the more familiar and is presented, month by month, week by week and even day by day in a number of indices of share prices such as that of Moody's Services (reported by the London and Cambridge Bulletin), the Financial Times, the Institute of Actuaries or the Investors' Chronicle. None of these indices quite correspond to our selection and treatment of shares and their values, but for the sake of illustration the Moody's Services price index of about 90 industrial shares may be compared with the average values of the shares of our 'very large' companies. Between September 1936 and September 1951 the Moody's index rose 18 per cent, the median[10] capital gain for our large companies averaged 23 per cent. The two measures of the changes in the level of values are close enough to allow comparisons of the variation between single company results and between general averages from time to time.

Chart A is a semi-logarithmic chart which attempts a visual presentation of the comparison. The September Moody's index for each of the fifteen years from 1936 to 1951 is plotted horizontally, the dispersion of our *very large* single companies capital gains is plotted vertically for the year 1951.[10] It is apparent that the inter-

[10] A seven point scale is used. The points include not only the maximum and minimum and the upper and lower decile gains of the very large companies, appearing in Table III, but the quartiles and medians as well, appearing in the table to the appendix. Just as upper and lower deciles record the gains less than which were made by 90 per cent and

company variation 'fanning out' over the fifteen years (a reasonable investor's holding period for any stock) is much wider than the time variation year to year. But we may apply a more thorough test, using not the year-to-year fluctuation of the Moody's Services index but the *monthly* fluctuations during these fifteen years, a total of 180 quotations. The resultant frequency distribution of month-to-month general index of share prices is much less widely scattered

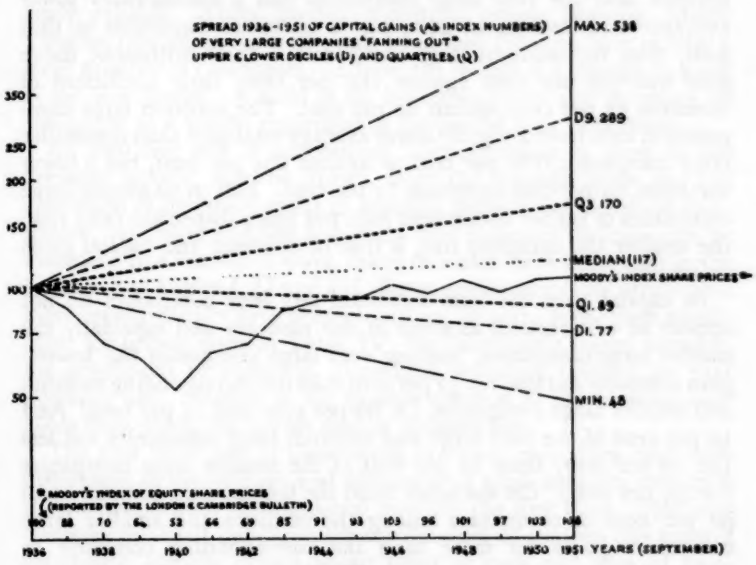

CHART A

Fluctuation of an Index of the Average Level of Share-prices compared with Spread of Capital Gain on Shares of Single Very Large Companies.
(Illustrating Table 3 and Appendix Table.)
(*Logarithmic Scale.*)

than the prices of even the individual *very large* companies. The coefficient of variation is 19.5 per cent compared with the 61 per cent appearing in the first column of Table III. The period 1936-51, including as it did the month of Dunkirk, was far from a particularly stable fifteen years for the general index of share prices.

It would thus appear that the dreaded variability or fluctuation of

10 per cent of the companies, so the upper and lower quartiles record the gains less than which were made by three quarters and one quarter of the companies. The median is the gain less than (or more than) which was made by half the companies. It is given as a measure of the average gain because it is nearer (though still above) the share price index for September 1951 than the arithmetic mean.

share prices from time to time is far less wide than the variability of the shares of one company rather than another over a fifteen-year period. This fact points to the greatly increased security obtained in 'spreading' the risks by investing in a number of companies. It is a point that should be taken up when discussing the encouragement of the small investor, with insufficient funds to spread risks for himself.

5. Comparing the three sizes among the large companies it appears that the very large companies had a considerably lower average total investment gain, but a narrower dispersion in that gain, than the medium large companies;— their arithmetic mean gain was 129 per cent against 188 per cent, their coefficient of variation 53 per cent against 62 per cent. The medium large companies in turn have a slightly lower average total gain than thesmaller large companies, 188 per cent as against 201 per cent, but a lower variation, 62 per cent as against 81 per cent. This trend among large companies of higher investment gain but more dispersion (and risk) the smaller the company size, is true of dividend and capital gains separately.

In capital gain the least successful *very large* companies do not appear so unsuccessful as some of the medium and especially the smaller large companies. Among very large companies the lowest-gain company *lost* less, i.e. 52 per cent than the corresponding medium and smaller large companies, i.e. 86 per cent and 74 per cent. And 10 per cent of the very large and medium large companies lost less (i.e. 23 per cent) than 10 per cent of the smaller large companies (i.e. 34 per cent). On the other hand the highest-gain company and 90 per cent of companies among the medium and smaller large companies *gained* far more than the corresponding company or companies among the very large. The highest capital gain, one of +1106 per cent was made by a medium large company.

Before concluding, however, that the very large, or medium large, companies though not offering such financial prizes are safer and do not show such extreme losses, we will look (Section IV) into the possibility of complete failure.

III

The conclusions to be drawn from the tables (I, II and III) which detail and analyse the investment gains of large joint stock companies according to their size but regardless of their particular industry, require further testing. It is possible that the differences apparently due to size were in fact due to the industrial composition of each size-class. The results on very large companies might, for

instance, be due to the type of industry in which very large companies might tend to specialize. It is prudent, therefore, to isolate the factor of size (as well as other factors) by grouping companies into our three standard sizes *within one industry group*.[11] In many industries even when grouped, there are not enough companies to make valid comparisons, but three industry-groups, namely Distribution, Engineering and Textiles contain enough companies (i.e. over 10) in *every* size grade to make comparison between these subdivisions fairly reliable. Three further industrial groups Brewing, Motor Vehicles (including Aircraft), and Food and Tobacco have in total a large number of companies (i.e. over 28) though not enough in some of the size grades. A total of six industry-groups can therefore be compared as a whole, regardless of the size of their companies.

At least five sets of conclusions (corresponding to those in the previous section) may be drawn, from the average levels and the dispersion of investors' gains in separate industries and sizes of companies. Averages and the dispersion that indicates the risks can be measured in a variety of ways, many of which have been used in the lower half of Tables I, II and III. But to avoid too complicated a table three measures only have been picked out, as perhaps the most significant, for presentation in Table IV: the (arithmetic mean) average, the coefficient of variation, (standard deviation divided by that average) and, because of the greater concern of the investor over losses than gains, the lowest gain or greatest loss.

The first three sets of conclusions are new, since they deal with differences in the average and dispersion of gains between industries that are separately distinguished now for the first time. The later conclusions about industries separately tend to confirm the general conclusion already drawn about types of gain and sizes of companies. All five conclusions are illustrated in Table IV.

(1) The average level of total gain, between 1936 and 1951, varied widely for the different industry groups. Measured by the arithmetic mean, textile companies gained far the most in all sizes, with distributive trade second, at least for the medium and smaller large companies. Partial explanations for the outstanding gains made between 1936 and 1951 by investors in textile companies were the comparatively low level of textile share prices (and even the passing of dividends) in September 1936 when share prices as a whole were at a peak, and their relatively high level in the absence of competition from foreign countries in 1951. But whatever the exact reasons the differentiation of textile gains illustrated the like-

[11] 'Group' is used since companies in somewhat different industries, as ordinarily defined, may be grouped together.

lihood that the circumstances of one industry[12] may be a general factor strongly influencing the specific fortunes of constituent companies.

(2) The variability or dispersion of the total gains relative to the average, which forms one measure of the degree of inter-company risk, also differed from one industry as a whole to another, particularly among the *smaller* companies. Measured by the coefficient of variation, total gains from investment in the smaller distribution companies had nearly twice the dispersion of the total gains in the smaller engineering companies, i.e. 95 per cent as against 51 per cent. Among the *very* large and *medium* large companies, relative dispersion in total and dividend gain did not differ so widely between the industry groups, and there were some striking uniformities in the patterns. Four out of the six subdivisions of *total* gains involved (three industries each with the two larger sizes) had coefficients of variation between 46 and 53 per cent; four out of the six subdivisions of *dividend* gains had between 19 and 23 per cent; five out of the six subdivisions of *capital* gains had between 49 and 59 per cent.

(3) To most investors, risk probably means not only general variability in the financial gain over a number of years as measured by these coefficients, but more particularly the chance of loss or of a relatively very low gain. The first column of Table 4 shows that losses were made by some companies in every industry group except breweries. But if we consider the bulk of companies distinct differences appear between industry groups. Distributive trades were, with brewing, as the Appendix shows, most liable to loss or low gain, textiles least so.[13]

It is clear from points 1, 2 and 3 that there were in 1936-51 distinct industrial differences. An investor if he concentrated upon investing in several companies of one industry rather than another would, in short, have fared differently. This conclusion so far as it goes, has a practical bearing and indicates the reduction of risk by

[12] Gains did not differ significantly as between the different branches of the textile industry. Cotton, wool and 'other textiles' all showed in 1937 very low gross trading profits as a percentage of sales turnover, 5.5 per cent, 5.5 per cent and 7.1 per cent respectively, when compared with the average of all economic activities (9.0 per cent) in the same year. In 1948, 1949 and 1950 the profits per turnover of all these branches were higher than the average. (See *Report* of Commissioner of Inland Revenue, Cmd. 9038).

[13] Comparing the lower quartiles, indicating the total gain which a quarter of the companies failed to make, distribution seems to have been distinctly more risky than the other industry groups and particularly the *very* large and *smaller* large distribution companies, with a lower quartile total gain of only +26 per cent and +29 per cent for these sizes, and for all sizes +33 per cent. Textiles, on the other hand, turned out safest for the investor in 1936, with a lower quartile total gain of +140 per cent for all sizes. Engineering (with +69 per cent for all sizes) turned out next safest from loss or very low gain. Like the distributive trades its very large and smaller large companies (with lower quartile total gains of only +44 per cent and +64 per cent over the fifteen years) were less safe for the investor than the medium large companies.

spreading investment over the companies of *several* industries. Differences between industries as a whole must, however, not be exaggerated and do not always conform to rule. Apart from textiles and breweries there is no wide, consistent, divergence of companies in any one industry group from an average pattern common to all industries. The particular industry in which the company is engaged has, in short, *some* influence on the level and dispersion of its gains, and stability of its dividend, but not a paramount influence. There are evidently other strong influences at work such as the size of the company and the policy and efficiency of the Board of the individual companies.

(4) Capital gains were in every industry group about two to three times as variable, measured by the coefficient, as dividend gains. Even when we consider the same size grades within each industry this proposition is true everywhere except medium large textile companies where the capital gains are more variable than the dividend gains, but not *twice* as variable. The general comparison drawn from Tables II and III is thus confirmed, industry by industry. The main risk of investment in any one large company within one industry group arose (as far as our fifteen-year span goes) from changes in the price of its shares rather than differences in dividend paid out.

If we concentrate on the lowest gains (or the greatest losses), as the main risks an investor fears, the greater risk from capital gain is strikingly demonstrated in Table IV. In fact only one company (in distribution) paid no dividends in the period. For the bulk or majority of companies in all industry groups, risk might be said only to arise on capital gains.[14]

(5) Comparing sizes within industry groups the trend remains true that the larger the company the lower the average investment gain. On average the very large companies had lower total, dividend and capital investment gains than the medium large companies and in engineering and textiles, but not distribution, the medium large had lower total, dividend and capital gains than the smaller large companies.[15]

Within each industry, with the partial exception of textiles, the high-and-wide or low-and-narrow rule still holds that the higher the

[14] In no industry group was the lower-quartile *dividend* gain (i.e. the gain of the company one quarter from the bottom) less than +55 per cent i.e. 3¾ per cent per year and in no size grade within any industry group was it less than +23 per cent. On the other hand, except in textiles, no lower-quartile *capital* gain was above +4 in any industry group or *above* +17 in any size grade within an industry.

[15] It must be stressed that investment gains are not a final test of success or efficiency. Another possible test, accounting gain, often yields opposite results; the larger companies increasing their assets faster than the smaller.

TABLE IV

SUMMARY MEASURES OF DISTRIBUTION OF GAINS (1936-51) OF LARGE COMPANIES IN SEVERAL INDUSTRY GROUPS

Company Sizes separated	TOTAL GAIN *Lowest Gain* (%)	TOTAL GAIN *Arithmetic Mean* (%)	TOTAL GAIN *Coefficient of variation*	DIVIDEND GAIN *Lowest Gain* (%)	DIVIDEND GAIN *Arithmetic Mean* (%)	DIVIDEND GAIN *Coefficient of variation*	CAPITAL GAIN *Lowest Gain* (%)	CAPITAL GAIN *Arithmetic Mean* (%)	CAPITAL GAIN *Coefficient of variation*
Distributive Trade									
Very Large	−49	+ 86	52%	+ 0	+ 64	21%	−49	+ 22	53%
Medium	− 6	+ 200	60%	+48	+ 102	20%	−54	+ 98	78%
Smaller	−11	+ 190	95%	+27	+ 100	29%	−52	+ 90	92%
Engineering									
Very Large	+11	+ 141	48%	+38	+ 81	19%	−32	+ 60	52%
Medium	−82	+ 149	35%	+ 4	+ 93	26%	−86	+ 56	51%
Smaller	+ 8	+ 186	51%	+38	+ 118	28%	−37	+ 68	55%
Textiles									
Very Large	+32	+ 250	50%	+43	+ 99	23%	−11	+ 151	59%
Medium	−44	+ 289	47%	+22	+ 138	37%	−66	+ 151	53%
Smaller	+64	+ 409	70%	+74	+ 175	35%	−11	+ 234	80%
All Sizes of Large Company									
Distributive	−49	+ 177	79%	+ 0	+ 95	29%	−54	+ 82	101%
Engineering	−82	+ 159	48%	+ 4	+ 98	24%	−86	+ 61	52%
Textiles	−44	+ 321	63%	+22	+ 141	35%	−66	+ 180	70%
Food and Tobacco	−49	+ 145	67%	+ 0	+ 87	27%	−74	+ 58	80%
Motors	−20	+ 118	51%	+31	+ 84	21%	−74	+ 34	56%
Breweries	+ 3	+ 73	34%	+50	+ 77	39%	−45	− 4	41%

average gain, the wider the variation even though that variation is measured relatively, that is by dividing the measure of absolute variation by the average. This trend is illustrated in distribution by an average gain (expressed throughout this paragraph as a percentage of 1939) of +200 for medium and +190 for smaller companies coupled with a coefficient of variation of 60 per cent and 95 per cent as against the very large companies' lower average gains of +86 coupled with a narrower coefficient of variation of 52 per cent. In textiles, similarly, we found an average very high total gain of +409 for the smaller companies coupled with a wide variation of 70 per cent, as against the very large companies' lower average gain of +250 coupled with the narrower variation of 50 per cent. In engineering the same trend appears in an average total gain of +186 for the smaller companies coupled with a variation of 51 per cent as against the very large companies' lower average gain of +141, coupled with a narrower dispersion of gains, measured in a coefficient of 48 per cent.

IV

In our analysis of the comparative success of investment in large joint-stock companies we have taken the standpoint of the potential investor contemplating the situation in September 1951 and judging risks of existing large companies from the experience of their investors during the past fifteen years — in short, judging future prospects from past 'form'. The risks of loss may, however, be underestimated since, by this approach, any companies not surviving the fifteen years, or so reduced in nominal capital as no longer to be included among large companies, are omitted. These additional chances of loss to which a set (or 'cohort') of companies may be exposed can best be estimated by noting companies existing as large companies in 1936 but not in 1951.

Among the very large industrial and commercial companies of 1936 with over £3M. nominal capital, only three do not appear in 1951. One, the Imperial Smelting Company, became a subsidiary of Consolidated Zinc, all its ordinary and preference shares being taken over by this new company formed in 1945.

The other two, Platt Bros. (Holdings), and Amalgamated Cotton Mills Trust became, by capital reorganization, only *medium* large companies under our grading of size by nominal capital.

The price paid by a would-be holding company in buying the shares of another company (unless the shares were bought up after liquidation) is usually higher than market price and shareholders are

likely to fare better than average in a company like Imperial Smelting that becomes a subsidiary. The fortunes between 1936 and 1951 of shareholders in the two 'de-graded' companies (included in our tables among the medium large companies of 1951) were in Platt Bros. Holdings, a dividend gain of 98 per cent and a capital gain of 134 per cent and thus a total gain of 232 per cent, and in Amalgamated Cotton Trust a dividend gain of 129 per cent, a capital gain of 49 per cent and thus a total gain of 178 per cent. These gains are all well above the arithmetic mean gain for the very large companies. Thus:

	Dividend Gain	*Capital Gain*	*Total Gain*
Amalgamated Cotton:	98	65	163
Platt Bros. Holdings:	98	134	232
Arithmetic Mean of all very large companies:	79	50	129

For the very large companies, the relative frequency of loss or low gain is thus not increased by including companies which had, between 1936 and 1951, nominally failed to survive at that size or as independent companies. The pattern of risk before the investor of 1936 was much the same as that before the investor of 1951 who looked only at the 'form' of the surviving very large companies.

The medium large industrial and commercial companies numbered 134 in 1951. The names of five companies in this category appearing in 1936 were no longer in the 1951 list. Of these, one, the Pullman Car Company had its nominal ordinary capital reduced in 1937 to a tenth and had thus fallen into the smaller large company grade but, nevertheless, showed some returns to shareholders. The capital 'gain' was −79 per cent i.e. 21 per cent, of the purchase price of the shares was left in 1951; and dividends at the rate of 12½ per cent were resumed in 1949. A second company probably did better for its investors[14] but the third and fourth companies definitely went into liquidation one of them paying ordinary shareholders 1.76d. per 2s. share, the other £1 17s. 0d. per £2 share. Finally, the fifth non-surviving company, Callender's Cable and Construction Co. Ltd. became a subsidiary of British Insulated Callender's Cables Ltd. formed specially in 1945 and shareholders exchanged shares at a fair rate. A capital loss was suffered after that of about 30 per cent but with the fair share exchange rate and fairly normal dividend gain, shareholders did not suffer by 1951 any peculiarly heavy loss.

The risks of loss by investment in the medium large companies are heavier when non-surviving companies are included, but not so much

[14] Capital reduced from £1¼M to £¼M but dividends of 10 per cent paid in 1948, 1949, 1950. No information on prices for 1936.

heavier as bankruptcy and winding-up statistics generally might lead us to suppose. Non-survivors form only a small proportion, and non-survival does not mean complete loss to the investors of the stake they put in.

The case for adequate compensation discussed in the next section is strengthened by considering non-survivals but not greatly strengthened. Non-survival has been found more prevalent in the medium large than in the very large companies, and probably was in turn more prevalent in the smaller than the medium large companies. Our smaller large companies were, however, only a sample, chosen in 1951 and no sampling could be carried out for 1936.

It is probably in this smaller large size and in companies still smaller that the main incidence of liquidations and bankruptcies occur, particularly during the earlier years of a company's life.[17] Unfortunately, analyses of company liquidations hitherto carried out (e.g. Macgregor *Enterprise, Purpose & Profit*, 1937, Chapter IV; P. W. S. Andrews, *Economic Journal*, September 1937) have not distinguished between the sizes of companies.[18] Our own evidence, however, suggests that for the large companies, winding up and liquidation is not a big risk to shareholders generally compared with low dividend and falling share prices of companies continuing to survive. These are the risks we have discussed in the previous Section and the compensation for which will be discussed in the next.

V

The usual degree and shape have been established of the fluctuations and variations in dividends and market values that constitute the risk to the industrial investor. The question must now be put whether he is paid enough as a compensation for bearing these risks. Or, to put it in more precise economic terms, is industrial investment paid at a rate which will provide a sufficient incentive to the investors to risk the supplies of capital, which are required over and above the reserves re-invested by companies.

The degree of risk to the investor does not depend solely on the payment or non-payment of dividend and the fluctuations and variations to which his capital may be subject. It will depend also

[17] See Florence, *The Logic of British and American Industry*, 1953, p. 66, 173.

[18] An unsigned article in the *Economic Journal* for December 1931, gives however 'the Results of the 1928 New Issue Boom' and lists the issues of 284 companies. With £500,000 as the dividing line these may be split into larger and smaller issues (probably, but not necessarily, issues of larger or smaller companies). It will then be found that of the companies with the larger issues, those wound up by May 1931 (or where the issue had, by that date, no price) formed 19 per cent of the survivors; of the companies with the smaller issues those similarly failing formed as many as 66 per cent of the survivors.

on the circumstances of (i) his ability to withdraw his investment at any time, and, apart from withdrawal, (ii) his control over the use of his investment.

(i) The shareholder can, at least in listed public companies, sell his holding on the Stock Exchange and thus disengage his investment altogether, or re-engage in another company. This limitation of risk by the marketability of shares is perhaps the main function of the Stock Exchange.[18] The catch, however, is that the average investor is ill-informed on when and where to invest or disinvest; and if too many investors (or a few large holders) in any company take the same view of their interests and sell, the price of the shares will with this high 'shareholder turnover', fall considerably.

(ii) Legally, the shareholder has the right of controlling his firm. The joint stock company is a structure created — or, to be exact, incorporated — by the State, and the Golden Rule (to quote Sir Dennis Robertson), is that *control goes with risk*. The ordinary shareholder is normally given a vote on the appointment of directors, on the possible reduction (but not raising) of dividend, and other policies brought before the shareholders' meeting and he is legally and normally entitled to a vote in exact proportion to his holding of (voting) shares. But in real fact, unless he, or he and his friends, own a majority or a large enough minority of the shares, the shareholder is usually powerless.[19]

Moreover, it is possible under company law to issue classes of ordinary shares without votes, and to give certain classes more votes than others. A holder of (or a 'holding company' owning) a few

[18] After indicating that the risk which is uppermost in the investors' minds is the risk of depreciation in capital value, not the risk of diminution of income, Mr. Kaldor in his *Expenditure Tax* 1955 (p. 107), lists four types of risks on capital account which ordinary shares carry: 'illiquidity, lenders', borrowers', and speculative'. Illiquidity is the risk of a fall in capital values due to the possibility of a rise in interest rates; lenders' risk that of default or failure by a particular borrower (e.g. industrial companies are more risky than the government); the borrowers' risk that the expected yield may not exceed the rate of interest paid on loans to induce him to borrow; speculative risks the liability of a change in market value due to the revision of the market estimate which may, however, be offset by the marketability of shares. These risks, for which the shareholder must presumably be rewarded, have all been considered above in comparing investors' with post office savings gains, and discussing company failures and marketability. A further type of risk mentioned by Mr. Kaldor (p. 108) 'the risk of changes in the general purchasing power of money, of inflation and deflation' is taken up below.

[19] I have discussed in detail elsewhere (*Logic of British and American Industry*, p. 185-6) this powerlessness of the bulk of shareholders even though, between them (as is true in most large companies) they hold a majority of the shares. It appears to be quite taken for granted by leading American authorities (e.g. Graham and Dodd, *Security Analysis*, p. 577) that there are in the normal business corporation a few 'controlling stockholders' often opposed in interest to the rank and file; for instance, if they are super-tax payers, in favour of the company accumulating capital gains rather than paying out (taxed) dividends. In his *Risk, Uncertainty and Profit* (1921, p. 297) Knight made the point that the '*crucial* decision is the selection of men to make decisions'; but it appears that in fact the decision-making directors are coopted on to the Board with very little selection by the bulk of shareholders.

high-voting shares may thus control policy, however conscientiously the holders of the majority of lower-voting shares attend meetings or send proxies. The risk-taking control of policy is thus, in practice, usually divorced from the bulk of risk-bearers.

We may now proceed from the 'circumstances' of marketability and control to the direct question of actual payment. Is the ordinary risk-bearing shareholder in fact likely to be exploited as a result of reluctance to withdraw his investment or his lack of control? Exploitation in his case refers either to avoidable loss or to insufficient compensation for bearing the unavoidable risk or uncertainty.

This question of exploitation is by no means merely rhetorical. J. A. Hobson in his *Evolution of Modern Capitalism*[21] writes of shareholders as

> a great capitalist proletariat, who bear to the operators of finance a relation closely analogous to that which the labouring proletariat bear to the employing class. The ordinary investor, the small capitalist, must sell the use of his capital, as the labourer must sell the use of his labours, to some organizer of a business enterprise if he is to get any advantage from possessing it.

Nor is the question academic or merely journalistic. The leading American authority[22] gives a number of situations in which the managements' interests may be opposed to those of the shareholders, or, at least, of the 'outside' shareholders, i.e. the rank and file who between them so often own a majority of the shares.

Let us first assume that in industrial investment certain, stable income, with capital secure, is preferred to an uncertain income, even though there appears an equal chance of making an income £x above, or £x below, the secure stable income — producing the same income on the average of probabilities.[23] On this assumption the long-run average of income and capital gain on risk-bearing investment must, if there is to be compensation, not fall below the long-run average gain on stable and secure investment. A stable money income is obtainable from the Post Office Savings Bank paying 2½ per cent and the capital is secure as being repayable at the original money value at any time on demand.

Many of the surviving large joint-stock companies discussed earlier did not, during 1936-51, gain 2½ per cent a year for their investors, if changes in capital values are taken into account. Refering to Table I, and adding the first three rows, 5 (or 6½ per cent) of

[21] Ed. 1917, p. 242.
[22] Graham & Dodd, *Security Analysis*, ed. 1951, e.g. pp. 577, 605.
[23] See Lavington, *The English Capital Market*, 1921, pp. 85-7.

the very large, 11 (or 8 per cent) of the medium large and 11 (or 12½ per cent) of the smaller large companies were found to have made a total gain for their investors of less than 25 per cent in the fifteen years. In all sizes of large company, 27 (or just under 9 per cent) of the companies made less than 25 per cent. This fact is expressed in another way, as in Table I, by one-tenth of all companies showing gains less than +27 per cent and thus failing, by a wide margin, to give as much to the 1936 investor by 1951 as if he had placed his money in Post Office savings. This relative loss — relative to a perfectly secure investment — rewarding risk-bearing negatively, occurred mainly on account of changes in capital values, that is, in Stock Exchange prices. Indeed, one quarter of all the companies lost 3 per cent or more in *capital* values. The average total reward in capital and dividend gain, to compensate for those risks of investing in unsuccessful companies was, for the fifteen years +180 per cent or 12 per cent a year. Two considerations must be put forward in qualification of this crude measure: the factor of changes in the value of money, and the factor of taxation.

For the present we must put aside the question of *real* as against money compensation for risk with only a brief calculation. During the period from 1936 to 1951 probably the most suitable index of price change to use is the recently calculated index of consumer prices. If this index is supplemented for 1936 to 1938 by the Ministry of Labour's cost of living index, prices seem to have risen between 1936 to 1951 as much as from 100 to 236. The effect upon real gains must be considered separately for capital, and for dividend gain.

It is, perhaps, pedantic to calculate *capital* gains in real terms, apart from the alternative uses of liquid funds in 1936. Buying and selling on the commodities market would have been lucrative, but hardly open to the ordinary investor, as against the trader or speculator type. Another possible outlet for the investment of liquid funds by the ordinary investor is real property.[24] But even here though large capital gains could be secured by sales in 1951 of premises with vacant possession, Rent Restrictions Acts would have made investment over 1936-51 extremely risky.

The main practical alternative to the saver was investment in fixed interest securities redeemable at par at any time (like Post-Office savings); or redeemable at par (or some fixed capital sum) at

[24] Estate duty statistics showed that in 1936 of the property held by persons dying in Great Britain, 34.8 per cent was stocks and shares, 21.1 per cent government and municipal securities, 12.7 per cent house property and business premises. The remaining proportions were (8.4 per cent) cash and savings bank deposits, (8.1 per cent) money lent on mortgages, etc., (4 per cent) land ground rents, etc. (3.8 per cent) insurance policies, (3.2 per cent) trade assets and (3.9 per cent) other property.
See Campion *Public and Private Property in Great Britain*, p. 104.

a specific date; or (like Consols) not redeemable at all. Whichever of these fixed-interest securities the saver chose in 1936 he would in *real* terms have lost heavily on capital account by 1951. Where the capital was redeemed at par in money terms the real value of his original investment would have been reduced to 42 per cent — the reciprocal of 236 — and where the capital was not redeemable at any fixed sum its market value would have been found less than 100 per cent even in money terms.[25]

As for comparative *dividend gains* in real terms, we have the statement in the official White Paper on the *Economic Implications of Full Employment* issued in March 1956 that 'taking the period 1938-55 as a whole . . . the real value . . . of dividends has decreased by 30 per cent' while the real value of wages and salaries increased 40 per cent. But the exact real value derived from income spread year by year over a period is difficult to compute if the investor is taken to have withdrawn it and spent it when paid, since the retail (and wholesale) price indexes were rising only gradually. But clearly, when the income is fixed interest in money terms, its real value becomes, with rising prices less and less every year, and there is no chance of a compensating higher money income derived from a higher rate of dividends or some additional dividend due to bonus shares.

In short, though the investor in ordinary shares relying on fluctuating dividends had on average not gained much in 1936-51 calculated in real terms, he had done much better than the investor in fixed-interest securities. If inflation and rising prices continue in the future (as they are quite likely to do) and business prosperity also continues, then there should be a sufficient incentive to switch investment from fixed-interest stock into ordinary shares. The main obstacle here is the investor's innocence. In urging him, through savings compaigns and propaganda generally to invest in fixed-interest stocks, governments have certainly 'taken him for a ride'; but most small investors still do not understand the extent of the 'ride' nor how much better off on average they would have been venturing into ordinary shares.

If, however, we compare venturing into ordinary shares, not with other forms of saving, but with plain consumption, including spending on durable goods, the incentive to save, not consume, looks in the real terms of 1936-51 somewhat slim. Had an investor in ordinary shares saved and banked all his dividends during the period he would, in monetary terms, have acquired on average a gain of 100 per cent on dividends, 80 per cent on capital. This total rise in

[25] E.g. Between 1936 and 1951, 2½ per cent Consols fell in price about 22 per cent, 4 per cent Funding Loan about 12 per cent, 3½ per cent War Loan about 18 per cent.

money values from 100 to 280 would have been met by a consumer price rise of 100 to 236 and the *real* total gain by dividend and capital changes reduced to 19 per cent on average — an average covering, as we have seen, wide risks over the fifteen years. If they had known these results beforehand, would many of those who did invest have invested *at all* either in fixed interest or in ordinary shares? Would many of them not rather have spent their money while prices were low?

Besides changes in the value of money, the effect of direct taxation on the real compensation for risk bearing must also be considered. In Britain one consideration stands out: that capital gains as against dividend gains are not taxed. It is partly for this reason that we have distinguished capital and dividend gains in Tables II and III and the reader can, if he chooses, work out total gains net of income tax on various suppositions as to the weight of tax on dividends. Since many industrial investors would be subject to sur-tax an overall average rate of tax on dividends for the period 1936-51 might well be taken as 50 per cent. In that case, any given capital gain is in net reality twice as valuable as a similar dividend gain. On the other hand as we have seen, capital gains are far more risky and uncertain!

Investors in ordinary industrial shares did better on average between 1936 and 1951 than investors in fixed-interest securities and perhaps than investors in property, at least house-property, but the main question is whether these average rates of gain, monetary or real, for the ordinary shares of companies as a whole are high enough to attract investment in the risks of any *one* company, particularly by the small man unable to 'spread' his risks? It is a commonplace that on the money market average rates of interest are normally the higher, the greater the risk as estimated by the security offered and the time elapsing before repayment of the principal. Treasury bill rates usually run lower than Bank rate, Bank rate lower than yield on Consols, just as yield on Consols runs lower than interest on industrial debentures, and interest on debentures usually lower than dividend on preference shares.

In our investigation we have found the same tendency in the relation of risk and average payments. A rule has appeared when comparing different sizes and industries, that the average compensation in total gain is higher, the wider the relative variation between the gains of companies, i.e. the greater the inter-company risk. Thus the average arithmetic mean total gain is comparatively low, i.e. +135 per cent, on the very large companies but so is the coefficient of variation at 53 per cent. At the other end of the size scale the smaller companies have an average total gain as high and a co-

efficient of variation as wide as +201 and 81 per cent. Midway come the medium large companies with average compensation +188 per cent and coefficient of variation 62 per cent.

Sufficient companies, i.e. thirty or more, appeared in certain industries to make a separate analysis fairly reliable and the same tendency became manifest when comparing these industries. Apart from textiles, the average total gain and the coefficient of variation are *both* highest and widest for distribution where investors in over a quarter of companies gained no more than Post Office savers, next highest and widest for engineering, then for food and tobacco and lowest and narrowest for motors. It looks as though the riskier shares averaged a higher total gain — 'in compensation'. But this 'differential' may not be enough to obtain the full supply of risk-capital demanded particularly by the smaller (and riskier) companies.

VI

The assumption that stability and security is preferred to risks may, of course, be wrong. People, on average, lose sufficient money on race courses and in gambling, to yield handsome profits to bookmakers, casinos, pools and lotteries. Possibly like gamblers, industrial investors positively like taking risks and are prepared to make less, on average, than in stable investment, and are therefore *not* exploited. But there is the distinction between the uncertainties of industry and the actuarial risks that can, on the basis of the long run and of large numbers be calculated. In 'turf' accounting one horse is bound to win each race, but in industry *all* companies may lose over any period. Moreover, the shape and timing of industrial risks is very different from that of betting, football pools or lotteries, where the vast majority of the original 'stakes' are lost, but there is the ten thousandfold return within a day or a week to stagger the imagination.

Instead, a shape has emerged from industrial investment in which there is one instance of an eight or even a fifteenfold total gain gathered over the fifteen years, but nothing more spectacular. It is true that if share prices fluctuate very rapidly, a speculator may by quick buying and selling make a large fortune, but here we are interested in the longer term, e.g. fifteen year, investor.

This shape of risks and uncertainty has long exercised leading economists such as Professor Pigou but the facts have not, to the best of my knowledge, hitherto been collected. In Appendix I of his *Economics of Welfare*, entitled 'Uncertainty-Bearing as a Factor in Production', Pigou presents a 'Scheme of uncertainty' diagramatic-

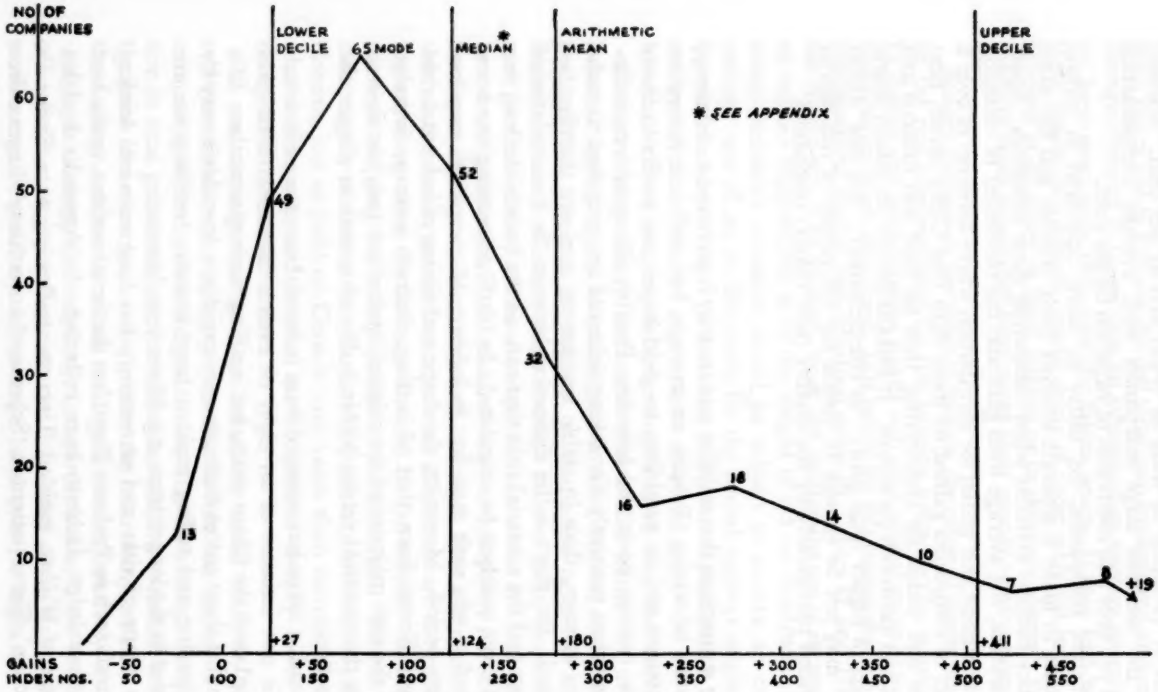

CHART B

The Shape of Industrial Investment Risks.

The Frequency Distribution of 304 Large Companies according to their investors' Total Gain 1936-51.

(Illustrating Table 1, but frequencies have been grouped and split for equal intervals of 50 from the original data. The shape follows the model in Pigou's *Economics of Welfare* ed. 1920, p. 918).

ally. Along the base line all possible yields (i.e. total gains) 'are marked off that may result from the exposure of a £ to the scheme in question'; and, through each point on this base-line an ordinate drawn 'proportionate to the probability, or the evidence, of the corresponding return'. The tops of all these ordinates are then joined.[24] The sort of evidence that Pigou 'requires' at least for a fifteen-year investment is supplied by our Tables I, II and III, and in Chart B a curve is given for all the 304 large companies (Table I, last column) to correspond with the theoretical illustration Pigou himself gives.

Broadly speaking, Pigou's curve illustrating his scheme of uncertainty has a shape remarkably similar to our empirical results, in its asymmetry or (positive) skew. His modal (or the most frequent) gain is well below arithmetic mean gain, as is ours, but the facts seem to show a greater 'skew' than Pigou expected — the results of our analysis show much fewer companies below the mode. In fact, the mode is not far from the gain which 10 per cent of companies (i.e. the lower decile at +27 per cent) did not exceed.

The actual pattern or distribution of the gains accruing to the various companies we have investigated may be contrasted on the one hand with the distribution of post-office savings gains and, on the other, with the distribution of betting gains and losses. The shape of both the post office savings and the betting or lottery distributions appears more attractive than that of industrial share gains, to those with money to invest. The average pay to the savers and 'punters' is less than to the industrial investors, and punters on the average, indeed are willing to suffer a loss, — otherwise bookmakers could not make a going and the state would see no advantage in floating lotteries.

Table V reproduces the summary measures in the lower half of Tables I, II and III. In the first column it reproduces the last column of figures of Table I, except that, to cope with negative values, the gains are incorporated in index numbers with their origin at 100. The second column gives the same measures marking the distribution of post office savings gains, and the third and fourth columns two illustrative shapes in the distribution of lottery winnings. The risks in the third column, Scheme A, are less than those in the fourth; it is a scheme where every tenth punter wins something, if only £500, for his £100. Scheme B in the fourth column allows only one punter to win any prize — but a large one. In both columns the State, or whoever manages the lottery, receives 20 per cent of the prize money and all punters — even the winners — lose their deposit.

[24] Lavington in his *English Capital Market* develops a similar diagrammatic model.

In the distribution of betting gains, as contrasted with the gains from industrial investment, it is only at the extreme positive end, affecting only the highest gains, that any gains whatever are obtained. To contrast the dispersion and skew of the 'attractive' betting shape with the shape of the observed investment gains we have to look at the extreme tenths and even the single highest and lowest values.

TABLE V

MEASURES OF THE DISTRIBUTION OF INDEX NUMBERS OF GAINS BY 15-YEAR INVESTMENT IN INDUSTRIAL SHARES AND IN THE POST OFFICE SAVINGS, AND BY BETTING IN LOTTERIES

	Industrial Shares 1936-51 (*See Table I, col. 4*) *expressed as Index No.*	*P. Office Savings Bank*	*Lotteries* Scheme A 10,000 *tickets of* £100	*Lotteries* Scheme B 10,000 *tickets of* £100
Arithmetic Mean	280	137½	80	80
Most frequent value (mode)	150-200 say 175	137½	0	0
Coefficient of Variation	64%	0	3756%	10,000% (app.)
Lowest Gain	18	137½	0	0
10% showed gains less than (D1)	127	137½	0	0
90% showed gains less than (D9)	511	137½	£500	0
Highest Gain	1635	137½	£300,500	£800,000

Most lotteries offer gains of a shape between Schemes A and B. Thus a Russian fifteen-year State loan reported in Pravda (June 10th, 1954) offers, for each total subscription of a million 100-ruble bonds one prize of 10,000 rubles. Like Scheme A there are lesser prizes, 8749 of them. Nevertheless, this means that prizes only accrue to 8¾ per thousand punters and as in Scheme B, even 90 per cent of punters will not gain more than 0.

Apart from the visual model of Chart B, the lack of symmetry or degree of skew can be grasped simply, though roughly, by those not familiar with statistical coefficients through a particular contrast. This contrast lies in the distance from the most frequent gain (*a*) of the lowest gain (or that not exceeded by 10 per cent) and (*b*) of the highest gain (or that not exceeded by 90 per cent).

DIFFERENCE OR 'DISTANCE' FROM MOST FREQUENT GAIN
(0 for lotteries, 175 for shares)

	Investment in Industrial Shares	*Lotteries* Scheme A	*Lotteries* Scheme B
Of Lowest Gain	− 157	0	0
Of Highest Gain	+1460	+£300,500	+£800,000
Of Gain not exceeding			
10% of Co. (D1)	− 48	0	0
90% of Co. (D9)	+ 336	+£500	0

The industrial share gains are obviously skew, plus and minus distances are far from being the same, but they are not as skew as the lottery gains which appear so attractive to the punter.[17]

Both the illustrative betting shapes, where the skew (and dispersion) measures are based on the more extreme cases, appear at first sight at an opposite pole to the post office savings, with coefficients of 1.00 for dispersion and +1.00 for skew as against o and o. But that is not so. Opposite to betting is the situation where an 'entrepreneur' may lose much more than he has put into a *particular* venture or plant and where with one wrong decision his whole business may go bankrupt. This unlimited 'business' shape of risk is that mainly discussed by Shackle and most economists who use investment in the sense of outlay on physical plant, not in the (popular) sense of buying shares. The shape of the risk to an investor in the ordinary shares of a limited company is of the betting, not the 'business' type. The very fact of limited liability limits the investors' loss, as in betting to his original stake. The industrial investment by company shareholders is similarto (and its risks are half-way between) secure post office or gilt-edged saving, and 'speculative' betting.

The betting analogy is thus relevant to the question of the adequacy of the compensation for particular shapes of shareholders' risks. If average gains are insufficient to stimulate the required supplies of capital subject to the peculiar— part secure, part speculative— shape of industrial shareholders' risks, and the peculiar circumstances attaching to shareholding, the immediate solution is either or both (*a*) to increase the average reward, and (*b*) to change the shape of risks and uncertainties.

VII

(*a*) The adequacy of a reward to any factor of production depends, in the first place, on the reward offered that factor in alternative uses. Whether the average reward for capital risked in the ordinary shares of large English companies is adequate must depend on comparison with the reward for the loan of capital on terms supposedly less subject to risk, those, for instance, of government fixed-interest stock. Under conditions of rising prices and inflation which have

[17] A statistical coefficient of skewness ranging from o to 1 and based on the highest (H) and lowest (L) gain and the median average (M) can be formulated as $\frac{H + L - 2M.}{H - L}$ This works out at +.75 for the shares, +1.00 for both lotteries. A coefficient similarly based on the first and ninth deciles (D1 and D9) can be formulated as $\frac{D9 + D1 - 2M}{D9 - D1}$ This works out at +.49 for the shares, +1.00 for Scheme A.

subsisted since 1936 (and have since 1951 been, if anything, intensified) the rewards in interest and capital appreciation on government stock have been, and are likely to be, *in real terms* extremely low, if not negative.

If price inflation continues, and there is little ground for rational and knowledgeable people to believe otherwise, investment in an assortment of ordinary shares is likely to be actually less risky than investment in fixed-interest stocks. At the existing rates of reward the more rational investors in these stocks are likely to transfer at least some of their 'gilt-edged' investment into ordinary shares.

Judged, then, by reward in the main alternative use, reward on investment in an assortment of ordinary shares appears more than adequate, and should have attracted away many of the savings that went into fixed-interest stocks. Perhaps, neutralizing this attraction, however, comes the over-riding and disturbing possibility that given the two alternatives in real reward some of the knowledgeable investors of 1936 would have chosen neither — would not have invested their money at all — but spent it.

(*b*) But are people (even the prudent who have saved) rational in their attitude and knowledgeable on the distribution and shape of investment risks? If not, can they not be made at least more knowledgeable, so that whatever reasoning ability they possessed could be applied to winnow (i) the chaff of phobia from (ii) the grain of true risk more accurately and realistically?

(i) The whole mechanism of issuing shares and buying and selling them on the Stock Exchange has, among the general public, a literally fearful reputation. Only last year a speaker at the Labour Party Conference referred to 'the present obscene exhibition continuing on the floor of the Stock Exchange'. A regular mythology of sinister powers includes stereotypes of the share-pusher, bucket-shop, and spiv speculator battening upon the 'sucker' and of 'finance capitalists' such as Mangan in *Heartbreak House* manipulating share-prices — stereotypes which have frightened off possible investors to an irrational extent. These phobias develop rapidly in a fog of ignorance. Certainly, most potential investors in England know far less of the simplest principles of company accounts and the Stock Exchange than of the most complicated subtleties of turf accountancy and the race-course.

(ii) People's fears of investment in ordinary shares, though exaggerated, are founded, however, on a certain substratum of true fact and practice. Some of these facts and practices could be altered, others not.

Mainly alterable are the risks we have laid bare measured by the wide dispersion of gains of the several companies (particularly their capital gains), and by a peculiar moderately skewed distribution of these gains which appear to be a shape of risks and uncertainties psychologically repugnant to most people. The wider the dispersion of gains in this shape (e.g. in smaller companies or in certain industries) the greater we found the average gains, presumably as extra reward for overcoming greater repugnance. Such repugnance must be accepted as fixed, together with the apparent fondness of human nature for the extremely skew-shaped distribution of betting chances. Investment in industry is not likely ever to be made to yield the betting *shape* of risks, and change in risks and uncertainties to make industrial investment less repugnant must therefore be *a change towards less dispersion in gains* and *greater security*, not towards more 'sport' and high play. This is particularly important in these days of high taxation when the bulk of savings and investment can no longer emanate from a few rich men who used to be able and willing to take wider chances. The will to risk is less but the need as great. Security undoubtedly ranks high today in the hierarchy of human aims but there is no reason for supposing the general economic situation to be any more secure than say in the Victorian era.

Though the risks of investing in one company rather than another are mainly unalterable, greater security can be obtained for the individual shareholder by spreading investments over a number of companies. The small man is unable to invest directly in several companies, but he can be encouraged to own shares in one investment trust with diversified investments.

More alterable are the risks involved in certain procedures connected with shareholding. The flotation and operation of some individual companies and the exchange of their shares have, in the past, been subject to abuse and deception by company promoters, directors and stock jobbers and brokers. These abuses are being tackled by amendments in Companies Acts and by the Stock Exchange authorities. But people's fears, unreasonable as well as reasonable, might be further allayed by more direct and obvious State supervision (such as that of the U.S. Securities and Exchange Commission created in 1933) over the original flotation of shares, the government of companies and the exchange of shares. In all these activities the main stress is on the publication of the truth, all the truth and nothing but the truth as a check on the tipster and the venal press and vested interests. Elsewhere[18] I have published

[18] *The Logic of British and American Industry*, pp. 288-91.

details of a possible programme of reducing shareholders' risks. It is sufficient here to conclude with two main principles: the potential investor, now a prey to vague fears, must somehow be taught the true facts; and the facts to teach him must be publicly disclosed and, by analysis, made easier to teach. May this article help in the teaching!

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APPENDIX ON STATISTICAL MEASURES

My article has been written on the assumption that readers are not familiar with any statistical measures except the 'average' (i.e. the arithmetic mean) and the conventional coefficient of variation and even the latter has been explained. There are several other summary measures of the average and of the degree of dispersion, and measures also of the skew of a distribution which I have applied to the data. In fact, other measures of relative variation such as a coefficient derived from the interquartile range, the interdecile range or the average deviation might in some respects be more suitable for the data here discussed. I have worked them out as alternatives for the results presented in Tables I, II, III and IV. The most frequently used of these alternatives, the coefficient of dispersion derived from the interquartile range (which is normally lower than the Pearsonian coefficient of variation) appears in the table to this appendix. The several measures of relative variation were found in general to conform[10] and to confirm the conclusions set forth in my text. Measures of relative skew, based on the quartiles, have also been worked out as alternatives to the measures of skew based on the extreme cases and the deciles introduced (very gingerly) toward the end of this article. Since the distribution of gains is found to be skewed alternative measures of the average will of course not agree and the median is very much lower than the arithmetic mean, — a difference clear to all in Chart B. This difference is so important that the arithmetic means which have already appeared in Tables I, II, III and IV have again been entered in the table which follows, for easy comparison with the medians.

[10] The interquartile coefficient of dispersion can in all cases be seen to be lower than the coefficient of variation corresponding to it in Tables I-III; in half the cases from ¼ to ⅓ less; in seven tenths from ⅓ to ½ less.

APPENDIX TABLE

MEASURES OF THE DISTRIBUTION (ALTERNATIVE TO THOSE IN TABLES I-IV) OF THE GAINS, 1936-51, BY INVESTMENT IN 304 LARGE COMPANIES

	Arithmetic Mean	*Lower Quartile*	*Median*	*Upper Quartile*	*Coefficient of Dispersion (of Index No.)*	*Coefficient of Skewness*
	A.M.	Q_1	M	Q_3	$\frac{Q_3-Q_1}{200+Q_3+Q_1}$	$\frac{Q_3+Q_1-2M}{Q_3-Q_1}$
			All Industries: Analysis by Size			
TOTAL GAIN						
Very Large Co.	+ 129%	+ 52%	+ 84%	+ 165%	27%	+ .43
Medium Large Co.	+ 188	+ 78	+ 134	+ 277	36	+ .44
Smaller Large Co.	+ 201	+ 63	+ 146	+ 283	41	+ .25
All Large Co.	+ 180	+ 63	+ 124	+ 273	39	+ .42
DIVIDEND GAIN						
Very Large Co.	+ 79	+ 54	+ 68	+ 97	13	+ .35
Medium Large Co.	+ 103	+ 65	+ 86	+ 143	19	+ .46
Smaller Large Co.	+ 108	+ 65	+ 91	+ 152	18	+ .40
All Large Co.	+ 100	+ 63	+ 82	+ 126	16	+ .40
CAPITAL GAIN						
Very Large Co.	+ 50	− 11	+ 17	+ 70	32	+ .31
Medium Large Co.	+ 85	+ 5	+ 47	+ 134	32	+ .35
Smaller Large Co.	+ 93	− 3	+ 55	+ 118	38	+ .41
All Large Co.	+ 80	− 3	+ 42	+ 118	38	+ .26
			Analysis By Industry Group			
TOTAL GAIN						
Distributive	+ 177	+ 33	106	237	44	+ .28
Engineering	+ 159	+ 69	136	220	31	+ .11
Textiles	+ 321	+ 140	284	467	41	+ .12
Food and Tobacco	+ 145	+ 50	84	152	25	+ .33
Motors	+ 118	+ 55	86	152	24	+ .36
Breweries	+ 73	+ 35	61	77	13	− .24
DIVIDEND GAIN						
Distributive	+ 95	+ 55	82	124	18	+ .22
Engineering	+ 98	+ 65	89	120	14	+ .13
Textiles	+ 141	+ 75	128	167	21	− .15
Food and Tobacco	+ 87	+ 63	76	97	9	+ .23
Motors	+ 84	+ 57	79	97	11	− .10
Breweries	+ 77	+ 62	70	81	6	+ .16
CAPITAL GAIN						
Distributive	+ 82	− 22	+ 31	+ 111	46	+ .20
Engineering	+ 61	+ 4	+ 47	+ 89	29	− .01
Textiles	+ 180	+ 61	+ 132	+ 271	40	+ .32
Food and Tobacco	+ 58	− 11	+ 15	+ 66	30	+ .32
Motors	+ 34	− 11	+ 11	+ 66	30	+ .43
Breweries	− 4	− 30	− 10	− 1	17	− .38

THE COSTING OF INVESTMENT DECISIONS

by K. P. Norris

I

To follow out all the consequences of investing capital in a particular piece of industrial equipment, and to express them with reasonable accuracy in the common terms of money, is usually an impossible task, and a decision to invest must always depend greatly on the experience, vision and judgment of those who take it. The truth of this is perhaps most evident when the new equipment is to make a new product, for which the size and duration of the public demand are largely unknown, and for whose costs of manufacture past experience provides little guidance. Even where new equipment is to be used to replace old, to make a familiar product for a known market — which is the situation considered in this article — there are many considerations, often important ones, which can only be expressed qualitatively. Present or anticipated shortages of labour with particular skills, or of labour in general, may prove decisive in favour of new equipment, even though an adequate case cannot be made on other grounds. Favourable effects on product quality may be anticipated, and it is only rarely that it is possible to give an accurate value to such effects, in terms of the enhanced price or the enlarged market that the improved product may command. The psychological effect on employees and customers of a policy favourable to new equipment cannot be neglected. For example, where change in the physical environment of the factory is a regular occurrence, managers and workers are likely to be more receptive to new ideas in general, and less attached to customary practices.

The difficulty of weighing together all the possible effects of investing in new equipment makes it all the more useful to measure all the effects that are measurable, even approximately, in terms of money — in particular, the effects on the cost of production — and to express the result in such a way that its significance can be easily grasped. If the measurable effects are sufficient to justify the investment, then the case is clear; if they are not sufficient in themselves, then the proportion of the investment that must be justified, if at all, by the imponderable advantages, is made apparent. In this way, the efficiency of judgment is enhanced, by narrowing the field in which it must operate unsupported.

II

Such measurements involve essentially the comparison of changes in operating expenses (and sometimes in income) with the capital expenditure that is necessary to secure them. The finding of operating costs for such a purpose has much in common with the normal procedures of cost accounting, but some caution is needed in making use of data from a cost accounting system, since there are important differences in aims, and therefore in methods. Originally, cost accounting was mainly concerned with recovery, that is, with finding the minimum price which would enable all the outgoings of a firm to be recovered; more recently, it has become at least equally concerned with the control of costs and expenses. For both these purposes, it is necessary that all items of expenditure should be covered.

On the other hand, an investigation of the effects on costs of replacing an old piece of equipment — henceforth called, for simplicity, 'a machine' — by a new one is concerned with the effects of alternative future courses of action, and therefore needs to take account only of those items of expenditure that will be incurred or avoided by choosing the one course, rather than the other. To this extent, therefore, such investigations are simpler than normal cost accounting, since there are many kinds of overhead costs which have little or nothing to do with the kind of machinery that is installed in the factory. It also follows that it is dangerous to make uncritical use of data borrowed from the normal costing system, and in particular of the rates of overhead costs allocated to particular processes or machines, since these may often include costs which do not in fact depend on the continuing operation of that process or machine, but must none the less be recovered, and have therefore been allocated on the most rational basis available. For example, the cost of personnel, training and welfare services may very reasonably be allocated to processes, and thence to products, on the basis of the number of persons employed, though a reduction in the number employed at a given process would not lead to a proportionate reduction in the cost of these services, if indeed it led to any reduction at all.

For these reasons, it is generally advisable first to distinguish and evaluate the physical effects of a new machine, and then to translate these into terms of costs. In many cases, it is found that consideration can be restricted to the costs of labour (including holiday pay and National Insurance), materials, power (including heat and light), maintenance of machinery, and occupation of space in the factory. Where the change of machinery involves a change in the demands

made on the general resources of the firm — for example, a change in the amount of space occupied in the factory — the price per unit at which this is brought into the calculation is not necessarily the average price, which would normally be used in cost accounting. If there is a decreased demand, the saving depends on what other uses can be found for the resources freed. If there is an increased demand, the increase in cost depends on the price at which additional supplies of the resource can be obtained, or, if they cannot be obtained, upon the cost of sacrificing other uses. In short, where alternative courses of action are involved, all costs must be treated as opportunity costs.

III

This principle finds its most important application in the treatment of capital costs. When two different machines are currently in use for the same purpose, the corresponding costs of production, in normal cost accounting practice, will both include, by way of depreciation, a proportion of the capital costs of the machines. If the question at issue were which of the two machines should be chosen for an expansion of total capacity, it would be correct, provided the rates of depreciation were acceptable, to compare these two costs. If the question is whether to buy further machines of the one type to replace those of the other, however, this comparison is misleading. The capital cost of the old machine cannot be incurred, or avoided, by deciding to continue to use it, or to replace it. The money is spent, and the only part that can be recovered is the amount, often only scrap value, that can be realized by selling the old machine. Both the original cost of the old machine, and the amounts which have subsequently been written off, are quite irrelevant. The proper comparison is between the operating costs of the old machine, plus any capital costs involved in continuing to use it, and the operating costs of the new machine, plus the capital costs of purchasing and installing it. In addition to its market value, the capital costs associated with the old machine include the cost of any reconditioning that may be necessary to enable it to continue in service.

A comparison involving operating costs and capital costs is essentially a comparison of unlike things, of a flow over time with a payment at a single point in time, and the method of reducing both to the same terms by spreading the capital costs over time, under the title of depreciation, is to some extent a convention. That this is so is borne out by the different rates at which the same machine may be depreciated for different purposes. There is the rate allowed by the

Inland Revenue authorities for the purposes of taxation. The accountant may feel that this represents only mechanical deterioration, and allows nothing for the risk of obsolescence, and may therefore charge a higher rate in calculating costs. Finally, the board of directors may feel doubtful whether there will be a profitable market for the machine's products during the whole of its working life, and that it would therefore be prudent, in deciding how much of profits should be put to reserve, to allow for an even higher rate of depreciation, even though it would not be justifiable to use this higher rate in calculating costs.

The basis of depreciation, then, is generally a matter of opinion, somewhat arbitrary and debatable, and no one can give a satisfactory explanation of why he has chosen twenty years, and not eighteen or twenty-two. For this reason, although it is logically necessary, in arriving at the sum to be spread over the period of depreciation, to subtract from the initial cost of the machine its residual value at the end of the period, there is little point in doing so, since the residual value is usually scrap value, or little more, and small relative to the initial cost. To subtract it is therefore merely equivalent to choosing a slightly longer but equally justifiable period of depreciation.

Similarly, if a comparison is made between an old machine and a new one, in which a rate of depreciation is assumed for the new machine, and subtracted from the saving in operating costs, the existence of a balance in favour of the new machine may depend on what rate of depreciation, within reason, is chosen. If the net saving is quoted per unit of product, as it often is, there may be some difficulty in appreciating whether this represents a substantial and indisputable advantage, or whether the costs are about equal, and the rate of depreciation chosen happens to give a small advantage to the new machine. The significance of an annual saving per machine is more readily appreciated, since it can be related to the cost of the machine. It is often an advantage, however, to avoid making the final figure in the calculation depend on any assumption about the major uncertainty, which is the right rate of depreciation.

IV

This can be done by dividing the annual savings in operating costs into the capital cost of the new machine, and so finding the number of years in which the capital outlay will be recovered. This is a significant figure from several points of view; it indicates the period of depreciation at which costs with the two machines are

equal; it indicates the lapse of time before a 'break-even' point is reached, at which the firm will have made neither profit nor loss as a result of the decision to invest; and finally it indicates the time at which the firm will regain the position of liquidity which it occupied before the decision, and all the resources used for the investment will be free for other uses. Whoever has the taking of such a decision will usually find it very hard to assign a precise value to the period of depreciation that is dictated by the varied considerations of mechanical deterioration, of the risk that a better machine may come along, of the risk of adverse changes in the market for the product—in short, of all the uncertainties of commerce and industry. He will find it rather easier, being told in what period the capital outlay will be recovered, and bearing in mind whatever imponderable advantages may be involved, to decide whether to classify the project as worth while, not worth while, or a border-line case. It is probable that such decisions depend more often upon how far ahead a firm is prepared to commit capital resources than upon mechanical deterioration or obsolescence.

In the 'ideal' economy, in which capital and other factors are supposed to move freely to where they are most productive, all the worth-while projects would be undertaken, since any deficiency in a firm's internal resources would be made up by external borrowing. In practice, because of the difficulty or the cost of raising fresh capital or because of reluctance to take on additional external liabilities, investment resources may be restricted to what can be accumulated within the firm, and some worth-while projects may have to be deferred. In such circumstances, provided there is no reason to expect the lives of the various machines to be appreciably different, the period of recovery provides a criterion by which the projects can be ranked in order of priority.

The period of recovery only has its full meaning, it is true, when it is less than the remaining life of the old machine. If it is greater, a new situation, in which the old machine must in any case be replaced, will arise before recovery can be completed. This detracts only slightly from the usefulness of the concept, however, since it still provides a measure of whether, by the time a new machine becomes a necessity, a sufficient proportion of the capital outlay will have been recovered.

It has been assumed so far that the capital costs associated with the old machine are negligible, and that therefore only the operating costs of the two machines, and the capital cost of the new one, need be taken into account. This situation is often met in practice. Some changes of method may be required, however, where the old

machine has an appreciable market value, or requires extensive reconditioning if it is to continue in use. Provided that the period of recovery, calculated on the excess of the cost of the new machine over the market value and reconditioning cost of the old machine, is less than the expected life of the old machine, it remains a valid criterion. If it is greater than the expected life, however, the period of recovery gives an answer biased against the new machine. This is because the calculation tacitly assumes that the benefit of avoiding the capital costs associated with the old machine is spread evenly throughout the period of recovery, whereas in fact, if the life of the old machine is shorter, the benefit occurs in the earlier years only, and is therefore at a higher rate, and the period of recovery is shorter. In such cases, a further calculation is necessary, in which the expected life of the old machine must be estimated. Making this estimate does not present the same problems for an old machine as for a new one, since it is not usually necessary to look so far ahead and mechanical considerations predominate. An annual capital charge is calculated for the old machine, and added to its operating costs. The difference between this total and the operating costs of the new machine is then used to calculate the period in which the capital cost of the new machine will be recovered, a period which does not, as has already been noted, have the full literal meaning of a period of recovery, but is a useful and valid measure of the rate at which recovery will be effected, up to the time when a new machine becomes essential.

V

A further cost of the decision to invest, which has not yet been considered, is that of interest. If the investment is made with borrowed funds, the case for including interest among the costs is obvious, and it is equally strong when the funds are the firm's own, since they might otherwise have been earning interest in alternative uses, such as the purchase of securities. A way of dealing with interest that is often favoured in calculations on the purchase of a new machine is to treat it as the variable in terms of which the final result of the calculation is given. This involves deciding what period of depreciation should be allowed for the new machine, finding the net annual saving after deduction of depreciation, and expressing this as a percentage of the capital outlay. The rate of return thus calculated has the advantage that it enables projects to be ranked in order of priority, irrespective of whether the expected lives of the machines are equal. The disadvantages of this method are two. First, it requires the assumption of a specific length of machine life, which raises the

difficulties of choice and interpretation which have already been noted, together with the further difficulty of appreciating what risks are already covered in the rate of depreciation, and what risks must be allowed for in deciding whether the rate of return is adequate. Secondly, the rate of return may be falsely interpreted as analagous to interest rates in general. In the first year of the new machine's life, the rate of return can be held to be the rate of interest on the capital outlay, but in succeeding years an increasing proportion of the outlay is recovered as depreciation, and the average rate of interest is considerably higher than the rate of return.

Rates of return, in short, may prove satisfactory when calculated according to known rules, and interpreted by those who are used to them, but they have pitfalls for the unwary, and, by comparison, the period of recovery has much to commend it. If a new machine of capital cost P shows savings of S per annum compared with an old machine, and the rate of interest is R (expressed as a fraction), the number of years N in which P will be recovered, together with annual interest on the unrecovered portion of P, is given by[1]

$$N = \frac{\log S - \log (S - RP)}{\log (1 + R)}$$

In research and development work on new machinery, there are some problems connected with capital investment to which the period-of-recovery approach is not applicable, and in which the equation can be used in the following re-arranged forms.

$$S = P\left[\frac{R(1+R)^N}{(1+R)^N - 1}\right] \qquad P = S\left[\frac{(1+R)^N - 1}{R(1+R)^N}\right]$$

For example, variables in the design of a new machine may affect the capital cost and several kinds of operating costs, and it is required to find the combination of the values of the variables that yields the minimum total cost. The assumption of a period over which the capital cost would be spread is unavoidable, and the equation for S gives the combined annual charge for interest and depreciation which will enable a capital cost P to be recovered, with interest, in N years.

At a still earlier stage in the history of a new machine, no designs may yet have been produced, and nothing is known of the effects of the design variables. It is believed, however, that a machine could be developed with certain properties — for example, the elimination

[1] See Appendix for derivation.

of some manual operations. The costs of development will be wasted, however, unless the savings due to these properties are sufficient to justify the capital cost. The amount of this cost is even more uncertain than the period of recovery that the potential users of the machine will require, and it is therefore useful to assume a value of N, and find P, the capital cost which would then be justified by a saving S. Although the capital cost is unknown, it is often obvious that it will be less (or more) than P, and that development of the machine is (or is not) worth while.

There is room for argument as to what is the appropriate rate of interest in all these calculations. The alternative uses for the funds, which are the purchase of securities or investment in other activities within the firm, may offer varying returns. It seems desirable to exclude from the interest charge most of the elements of risk, such as those peculiar to the product, the firm, or the industry, so as to avoid the danger of making a double allowance for them, once in determining the interest rate, and once in assessing whether the period of recovery is satisfactory. If consideration of all special elements of risk is to be thus deferred, the appropriate rate of interest is probably that obtainable on equities of low risk. In any case, the divergence between this rate and the other possible contender, the 'purer' interest obtainable on trustee securities, is at present small.

VI

The equation for the period of recovery can be adapted to deal with some cases in which the annual saving S is not a constant amount, but is expected to increase or decrease over the years. If S changes annually by a fraction F (which may be positive or negative), such that the savings in successive years are S, S $(1+F)$, S $(1+F)^2$, and so on, the number of years N in which P will be recovered, with interest R, is given by

$$N = \frac{\log S - \log [S - P(R - F)]}{\log (1 + R) - \log (1 + F)}.$$

The value of N for F=R is not directly obtainable from this expression and is in fact

$$\frac{P(1 + R)}{S}.$$

The need for a method of allowing for changes in the annual savings may arise, for example, because the maintenance costs of the

new or the old machine are expected to increase with the passage of time. In present circumstances, however, the cause of changes in savings which is most in the mind of anyone concerned with capital investment is an increase in prices. If operating costs rise, but capital costs remain constant — which might happen if wages increase, but labour productivity increases in the machine-making industries — it is meaningful to calculate a period of recovery on the basis of an increasing annual saving, since this gives a true measure of when the real value of the investment, in terms of purchasing power in new machines, will be recovered. If the rise in operating costs is part of a general inflation, however, this period of recovery is not meaningful, since the sum recovered is not of the same real value as the outlay, and the shortening of the period merely reflects the advantages of holding any kind of real values, rather than cash. When a firm has other uses in which the real value of its resources can be preserved, the desirability of investing in a machine is the same as it would be if there were no inflation, and therefore a period of recovery worked out on current values is an appropriate measure, except that if operating costs increase relative to capital costs, a treatment similar to that suggested above for rising operating costs and constant capital costs, but based on the relative instead of the absolute increase in operating costs, would be appropriate.

In practice, other ways of preserving the real value of resources are frequently lacking, and any investment in machinery, therefore, has an added attraction. The purchase of a machine is not, of course, a complete protection against inflation, since the transformation of cash into machinery is a process which, once accomplished, at once begins to reverse itself, by way of depreciation, and the accumulating depreciation funds lose real value in the same way as any other cash resources. It is generally unrealistic, however, to think in terms of one machine. Provided that a steady stream of investment projects is available, depreciation can be regarded as a revolving fund, most of which is at all times represented by machinery and is therefore protected against inflation. When inflation is anticipated, therefore, investments in general become more desirable than they would otherwise have been, but it is difficult to give expression to this in calculations concerning individual projects.

VII

The remaining factor which must be taken into account in assessing the advantages of investing in a new machine is the effect of taxation. This effect may be very complicated, and may vary

from firm to firm, and from year to year. In general, however, it is reasonable to assume that if a firm is making a taxable profit, the installation of a machine which reduces operating costs will lead to an increase in tax liability, which is offset by the depreciation allowance which the Inland Revenue authorities will give in respect of the new machine. If the savings exceed this depreciation allowance, they will therefore be reduced by the amount of the tax on the excess, and the actual period of recovery will be greater than that calculated before allowing for taxation. Since Inland Revenue depreciation allowances are based on fairly long machine lives, and seem to cover only mechanical deterioration, most worth-while investment projects show savings larger than the available depreciation allowance, and the lengthening of the period of recovery is therefore typical. The degree of lengthening varies with the difference between the period of recovery and the life assumed in the depreciation allowance. The following example, admittedly a drastic simplification, serves to illustrate the point.

A machine costing £12,000 will save, say, £1200 a year in operating costs. If interest is charged at 6 per cent, the period of recovery, neglecting taxation, is 16 years. Suppose now that tax is payable at ten shillings in the pound, and that the depreciation allowance (on a life of 20 years) is £600. The saving is reduced to £900, and the period of recovery, with interest at 3 per cent (i.e. net of tax), is 17 years. The effect is small, because the period of recovery before taxation is fairly near to the period on which the allowance is based. If for the same capital cost the saving had been £2400 a year, however, the period of recovery before taxation would have been 6 years, and after taxation, 9 years.

In short, apart from the recent investment allowances, which are peculiar in this respect, taxation does not affect the amount that can be recovered, but it does affect the time at which it can be recovered. Clearly, if the rate of tax were twenty shillings in the pound, it would be impossible to effect recovery, or to provide depreciation, in any shorter (or longer) period than that allowed by the tax authorities. It may be noted, in passing, that if a bad investment is made, which realizes only small savings, and has a period of recovery longer than the life implied in the depreciation allowance, the effect of taxation is to provide, in effect, additional savings, and to shorten the period of recovery. The tax authorities also offer some compensation, in the form of allowances, when a machine is scrapped before sufficient time has passed for depreciation allowances up to its full value to have been granted.

It is sometimes maintained that, since taxation does not reduce the

amount recovered, it does not affect incentives to invest in new machinery. If it is true, however, as has been suggested in this article, that the main considerations in deciding whether to invest are very often the increasing uncertainties of the more distant future, and the length of time for which capital resources must be committed, then the effect of taxation, with the present system of depreciation allowances, is to discourage investment. Our experience in recent years with the various and transient 'initial allowances', whose effect can be interpreted as a general shortening of periods of recovery, tends to support the second view, the implication of which is that the normal depreciation allowances are such as to cause a divergence between what is desirable from the point of view of costs (and therefore for the economy as a whole), and what is desirable for the individual firm, after taking account of the effects of taxation.

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APPENDIX

To find the number of years N in which an annual saving S, due to a capital outlay P, will enable P to be recovered, together with annual interest at rate R on the unrecovered portion of P.

The amounts unrecovered at the ends of successive years are found by adding the interest to the amount unrecovered at the end of the previous year (i.e. multiplying the latter by $(1+R)$, and subtracting the saving S). They are:

Year 1 $P(1+R)-S$

Year 2 $P(1+R)^2-S(1+R)-S$

Year 3 $P(1+R)^3-S(1+R)^2-S(1+R)-S$

Year N $P(1+R)^N-S[(1+R)^{N-1}+(1+R)^{N-2}+\ldots+(1+R)+1]$.

Now, by definition, the amount unrecovered at the end of year N is nil, therefore

$$P(1+R)^N=S[(1+R)^{N-1}+(1+R)^{N-2}+\ldots+(1+R)+1].$$

This equation may be arranged in a form which demonstrates that the present problem is equivalent to that of finding the present value of a series of N annual payments, discounted at rate R, thus

$$\frac{P}{S} = \frac{1}{(1+R)} + \frac{1}{(1+R)^2} + \frac{1}{(1+R)^3} + \ldots + \frac{1}{(1+R)^{N-1}} + \frac{1}{(1+R)^N}$$

$$\frac{P}{S(1+R)} = \frac{1}{(1+R)^2} + \frac{1}{(1+R)^3} + \ldots + \frac{1}{(1+R)^{N-1}} + \frac{1}{(1+R)^N} + \frac{1}{(1+R)^{N+1}}$$

Subtracting, $$\frac{P}{S} - \frac{P}{S(1+R)} = \frac{1}{(1+R)} - \frac{1}{(1+R)^{N+1}}$$

$$\frac{P(1+R)-P}{S} = 1 - \frac{1}{(1+R)^N}$$

$$\frac{1}{(1+R)^N} = \frac{S-RP}{S}$$

Taking logs, $$-N \log (1+R) = \log (S-RP) - \log S$$

$$N = \frac{\log S - \log (S-RP)}{\log (1+R)}$$

PRICE DETERMINATION IN THE WESTERN CANADIAN GARMENT INDUSTRY[1]

by WILLIAM LAZER

THIS article originates from a detailed investigation of the marketing of textile clothing by Western Canadian manufacturers.[2] It is concerned with the pricing objectives of garment producers, the specific methods used to establish prices, and the influence of retailers' and competitors' actions on pricing decisions.

I. OBJECTIVES OF PRICING

Pricing receives more emphasis on the part of Western Canadian garment manufacturers, wholesalers, and retailers than does any other aspect in the production or marketing of clothing. The large number of relatively small manufacturers, the similarity of garments produced by various companies, the keen and even fierce nature of existing competitive practices, and the ease of entry into the garment industry underlie the significant role of pricing. Yet despite this, the manufacturers studied pay scant attention to the consideration and determination of pricing objectives. During the interviews conducted even intensive questioning rarely achieved any direct statement of pricing goals by the manufacturers. Nevertheless, from the nature of the replies received at least five objectives could be inferred.

'Fair' return. In general, Western Canadian garment manufacturers do not set out to charge the highest possible prices for their garments in order to 'make a killing'. Nor do they attempt to

[1] This article is adapted from a doctoral dissertation, 'An Analysis And Evaluation Of The Marketing of Textile Clothing By Western Canadian Manufacturers,' completed in June, 1956, by William Lazer under the direction of Dr. Theodore N. Beckman for the Department of Business Organization of The Ohio State University. [The Editor wishes to call attention to N. Balkin's article 'Prices in the Clothing Industry', published in *The Journal of Industrial Economics*, Vol. V, No. 1, November 1956. Written independently by a British manufacturer, readers will find it an interesting comparison to Professor Lazer's article.]

[2] The study pertains to mass-produced textile clothing only, and excludes custom-made articles and items manufactured from fur and leather. The empirical research was conducted primarily in Winnipeg, Canada's third largest garment manufacturing center. The garment firms of Winnipeg dominate the entire Western Canadian industry. In 1952, they accounted for more than 72 per cent of the total value of factory shipments, and contained over 58 per cent of the garment manufacturing establishments of the four Western Canadian Provinces. [See the Dominion Bureau of Statistics publications *The Women's and Children's Factory Clothing Industries in Canada – 1952* (Ottawa, Ontario: Queen's Printer, 1954); and *The Men's Factory Clothing Industry In Canada – 1952* (Ottawa, Ontario: Queen's Printer, 1954)]. The non-random sample of twenty-six clothing firms selected for the research was not designed to represent a cross-section of the industry. Rather, it was chosen to include the largest and most efficient establishments in each of the men's, women's, and children's clothing lines.

maximize the profits received from each style number manufactured or to produce only profitable lines. Rather, they are mainly concerned with obtaining a 'fair' return for their total manufacturing activities by offering clothing at 'fair' prices. The concept of a 'fair' return, however, was not expressed in quantitative terms. For most of the manufacturers interviewed it seems to connote a 'good living' accompanied by a 'growing business'. For a few, the concept signifies an equivalent return to that offered by other business alternatives for the time and money expended. Whether or not a 'fair' return is realized is merely the result of the year-end evaluations of the total returns from all manufacturing operations. Garment producers try to assure that their pricing practices will yield an over-all just margin. In this regard, members of the industry differ very little from other business men since 'the notion of a "just price" is still strong in business mores. Compunction against charging more than a "fair profit margin" is a significant pricing factor.'[3]

Survival. The very nature of the keen competitive atmosphere in garment manufacturing suggests that survival is one of the important pricing goals of the individual firm. This basic drive to assure the existence of the firm by establishing prices low enough to obtain orders and still yield sufficient returns is especially evident in new and small manufacturing companies. However, even well-established companies are concerned about the continuation of their operations. For instance, in stressing the necessity of adequate financial preparation for survival, the owner of one of the largest Canadian garment manufacturing firms pointed out that, regardless of size, sooner or later a company must fall. While the inevitability of such a fall may be questioned, the concern for survival is apparent. Another prominent manufacturer emphasized that 'the life span of the average Canadian garment manufacturing concern is something less than seven years.' Although this statement cannot be verified statistically, the commercial failures recorded under the provisions of the *Bankruptcy and Winding Up Acts* indicate that the number of failures in the garment industry is high relative to other types of manufacturing. In 1954 there were more failures in the clothing group than in any other category of manufacturing.[4] Hence, garment producers desire to institute pricing practices which will assure survival, or even forestall inevitable financial disaster. Because of their fear of failure, manufacturers often slash prices drastically, frequently below the level necessary to cover out-of-pocket costs.

[3] Joel Dean, *Managerial Economics* (New York: Prentice-Hall, Inc., 1951), p. 452.

[4] For a detailed presentation of relevant statistics, see Canada, Dominion Bureau of Statistics, *Commercial Failures Under The Provisions Of The Bankruptcy And Winding Up Acts, Fourth Quarter And Year 1954* (Ottawa, Ontario: Queen's Printer, 1955).

Share of the market. The specific prices established by clothing producers are often designed either to increase or to maintain a company's share of the market. The price adjustments made to gain substantial orders from large mail order houses and retail chains, or to lure particular customers away from competitors, are often aimed at increasing a manufacturer's portion of the market. In addition, the willingness of some garment manufacturers to meet competitors' prices or to offer similar items at a price just a little lower than the quotations of other firms is frequently the result of an attempt to maintain a relative market position. Some of the 'low-cost companies' and producers of skimpy and inferior apparel rely almost exclusively on pricing as the device to gain market acceptance.

Breaking into a market. With the ease of entry of entrepreneurs into the garment industry and the constant influx of new firms, the problems of getting a place in the market assume major proportions. Specific pricing practices are frequently adopted in an attempt to overcome such problems. Both new manufacturers and established firms engaged in the production of new clothing items use low prices as a means of gaining a foothold in the market. Once a satisfactory market position has been attained, the companies usually alter their prices to bring them further into line with competitors' quotations.

Full range of prices. It is the desire of some garment manufacturers to produce and price garments so that customers will have a complete price range from which to choose. The realization of this objective enables manufacturers to cultivate almost all segments of the clothing market. By extending a full range of prices, manufacturers also encourage buyer comparison of prices and give salesmen opportunities of 'trading up' customers.

II. COST-PLUS PRICING

Cost-plus pricing — making an estimate of costs and adding a fixed margin for profit — is the general method employed by Western Canadian garment establishments in setting prices. In this respect, the pricing practices of garment manufacturers resemble those of other industries since 'studies of business pricing methods uniformly show cost-plus prices to be by far the most usual type.'[4] However, in the garment industry the basic price determined by the cost-plus system is generally modified in order to meet existing market conditions, namely retailers' demands and competitors' actions.

Use of cost figures. A common procedure among the manufacturers

[4] Alfred R. Oxenfeldt, *Industrial Pricing and Market Practices* (New York: Prentice-Hall, Inc., 1951), p. 162.

interviewed is to maintain cost records for almost every style number produced. These records actually serve as estimates of anticipated costs for a particular production period rather than a list of actual costs incurred in the manufacture of garments. In essence, these cost estimates are used to project the profit outcome of alternative pricing possibilities for the different style numbers. However, no account is taken of the variations which exist between the actual costs and the estimated costs of producting garments. Furthermore, as a guide for pricing, the recorded cost figures are often not even good estimates and the prices derived from their use may be somewhat unrealistic in terms of a cost-plus concept of pricing. In calculating estimated garment costs, producers do not allocate or consider the effects of sales volume on fixed costs. It is their general practice to accept the calculated cost estimates as constituting a record of actual garment costs which presents an adequate basis for pricing. As a result, the figures employed to establish a cost base for garment prices quoted by the concerns may or may not approach the true manufacturing costs.

Cost-plus method. Typically, the method of pricing garments begins with the calculation of estimates of direct costs. This is achieved on the basis of past experience and rules of thumb, the use of simple averages and allowances, and the costs involved in the manufacture of sample garments. The figures so derived represent anticipated costs for the respective production periods. To these bases, fixed percentage mark-ups are added to cover all indirect expenses and leave 'suitable' net profits. Then, the customary retail mark-ups are added to these total cost figures. The result is that the garments are given hypothetical retail selling prices. Such prices are then reviewed from the standpoint of the established retail price lines for the garments concerned, as well as the prices charged by competitors for similar items. In the event that discrepancies occur, alterations are usually made in order to adjust the hypothetical prices to the price lines specified by retail customers. Either the construction of the garments themselves might be altered to affect costs, or the manufacturers' margins adjusted, or both. Through this process, the suggested prices are brought into line with competitors' price quotations and the retailers' price demands.

By adding or subtracting the established price allowances extended to various types of outlets by the garment trade, the net list prices are fixed for different classes of customers. Some manufacturers allow a deviation of 15 per cent between prices quoted to mail order and wholesale customers and those quoted to chain and department stores. Prices charged to smaller retailers are often 10 per

cent higher than those paid by chain and department stores. To a large extent, these discounts are established by industry customs and through past dealings of the particular manufacturers with their customers.

After the net list prices have been set, sample garments are shown and the prices are subjected to the buyers' reactions. Further price adjustments may be made on the basis of customer reactions under actual selling conditions. Thus, the final prices determined are usually culminations of the consideration of both the cost factors and the existing market situation, rather than the results of a rigid cost-plus formula. Hence, cost-plus prices are used to establish price bases which can be shaped to meet market conditions.

Evaluation of cost-plus pricing of garments. The prevalence of the use of the cost-plus method of determining basic prices for garments suggests that this technique lends itself to the solution of pricing problems faced by garment manufacturers. Therefore, brief consideration is given to the relevant features which both encourage and limit the use of cost-plus pricing.

Garment manufacturers, like other business men, are faced with a pricing dilemma. It is impossible for them to obtain exact demand information and to estimate precisely the effects of their prices on sales, competition, and profits. Yet, prices must somehow be determined. The cost-plus system establishes prices, which, although they might not be attained in the market, are, nevertheless, bases for adjustments. In view of the lack of information required for more logical methods of pricing and the necessity of employing some fundamental procedure, the simplicity and ease of the cost-plus method is indeed appealing to garment manufacturers.

Some of the producers interviewed consider the cost-plus system to be a safe method for pricing. It provides them with an opportunity of knowing when garments yielding 'below-normal' profits tie up production facilities. In the long-run, cost-plus prices should cover all costs and yield normal profit contributions or 'just' returns. Since they afford only the usual fixed margins and not the highest prices which can be obtained for garments, such prices may facilitate customer acceptance. In addition, as the costs of manufacturers are lowered or raised 'corresponding' adjustments are made in the prices charged for garments.[4]

It has been indicated previously that the garment industry is an extremely competitive one and that the failure rate in garment

[4] In the case of rising prices, however, consumers may be faced with paying more than the original cost increases as a result of the calculation of distributors' mark-ups on a percentage basis of their increased costs.

manufacturing is high. However, 'when the products and production processes of rivals are highly similar (which is the case in garment production in Western Canada) cost-plus pricing may offer a source of competitive stability by setting a price that is more likely to yield acceptable profits to most members of the industry'.[7] Therefore, the use of cost-plus pricing may give a greater degree of competitive stability to the garment industry than would result through the widespread use of other pricing methods.

The fact that the cost-plus system is extensively employed in garment manufacturing and in other industries does not mean that it is the superior pricing method, nor that it is free of defects. The cost-plus method tends to assume a precision on the part of cost figures that does not exist in the calculations made by any of the garment manufacturers interviewed.[8] In addition, it establishes prices without reflecting market conditions and does not consider the demand for garments. (To an extent, garment manufacturers attempt to overcome this limitation by adjusting their prices to meet the demands for customers.) Furthermore, at certain times, garment producers are not concerned with using full costs in making pricing decisions, and hence, the prices derived by the cost-plus method are often inadequate. Nevertheless, from the garment manufacturers' point of view, the defects of cost-plus pricing are overshadowed by its favourable aspects and it is expected that this general method of pricing will continue to be employed.

III. OTHER METHODS OF PRICING

Most Western Canadian garment companies, at particular periods of time or in determining the prices of specific garments, deviate from the basic cost-plus method of pricing. The following are some of the other methods which are adopted in certain instances.

Intuitive pricing. Sometimes garment producers establish prices for new garments, high-style clothing, and novelty items on the basis of their intuitive 'feel of the market'. The actual process of setting prices cannot be accurately described. However, it seems that a garment manufacturer groups the important pricing factors together in an informal way in his 'mind's eye', and after intuitively evaluating the situation establishes a price. The fact that most garment firms are dominated by one individual increases the opportunity for pricing items through the use of an intuitive process.

[7] Dean, op. cit., p. 453.

[8] Since overhead costs are not calculated and allocated by the garment manufacturers in any precise manner, and since the companies are multiple-product firms, the cost figures used are just rough estimates.

Introductory pricing. Both new and established garment companies in Western Canada use introductory pricing methods. That is, new companies breaking into a market, or established firms entering a different market, often set low initial prices and accept extremely low margins in order to gain sales. When sufficient market acceptance is achieved for the introductory products such pricing practices are usually abandoned and 'more normal' prices are adopted. Thus, the companies' prices are brought into line with those charged by competitors.

Direct-cost pricing. In the event that unused productive capacity exists,[9] garment producers often adopt a direct-cost concept of pricing. It is common for manufacturers during slack periods to produce clothing at prices that will cover their direct costs, and, if possible, make some contribution to overhead. To an extent, this practice approximates a marginal approach to pricing. Instances were cited by the interviewees in which prices did not even cover all direct costs, yet were accepted since they enabled the manufacturer to keep his staff intact and thereby minimized losses.[10]

Premium-margin pricing. When the garments of manufacturers have some distinctive feature (e.g., a particular style, cloth) or, are of a novelty nature which gives the products preferred market advantages then premium-margin pricing is often applied. This is a policy of establishing relatively high prices in the early stages of the selling cycle of garments. At this time, the demand for them is likely to be more inelastic than will be the case at a later date with the ensuing increase in competition. Hence, manufacturers attempt to 'skim the cream off the market' leaving the skim milk for their competitors.

Price imitation. Many of the smaller garment establishments, the so-called 'low-cost producers,' the 'skimpy' manufacturers, new firms entering the industry, and even 'recognized' manufacturers in specific instances use a price imitation technique. They set prices which either imitate the price offerings of competitors or maintain a differential between the prices of other firms and their own quotations. In addition, large retailers often attempt to induce garment

[9] The existence of some unused manufacturing capacity in the garment industry for at least six months of the year is not uncommon.

[10] There is a reluctance to lay off skilled staffs who will seek employment with other companies and may be lost. The cost of recruiting and training new employees and the losses resulting from not being able to deliver orders on time during the busy season make businesses wish to keep skilled personnel, even if current receipts do not cover all their wages. There will be a limit to this because of the drain on cash reserves, and to take additional orders even below full direct cost may give something towards the wages of these people and so, in fact, reduce the drain on cash, thereby reducing the numbers which have to be laid off. Of course, such a preference in favour of retaining staff, which was expressed by several prominent garment manufacturers, means that part of their wage bill really becomes a short period overhead cost from the point of view of marginal analysis, and prime costs, strictly analysed, are accordingly lower than 'direct' costs.

manufacturers to imitate competitors' prices by 'playing the manufacturers off against each other'. Retailers frequently review a manufacturer's product line, select samples of the garments desired, show them to competing manufacturers, and seek price quotations thereby encouraging price imitation.

Full-range pricing. The objective of full-range pricing has already been discussed on page 126. The pricing technique used to achieve it deviates from the usual close association between costs and prices. Full-range pricing entails a review of the established prices for a line of garments (by use of the cost-plus method), and the adjustment of these prices upward or downward to round out the entire price range. Thus, particular prices are actually established on the basis of their relationship to the existing price structure.

Monopsony pricing. Two of the garment manufacturers interviewed cited pricing situations which tend to approach monopsony pricing. In both instances, the buyer mentioned represented a large-scale retail chain that had some knowledge of the manufacturers' costs and possessed limited garment production facilities of its own. The buyer quoted figures which his company would pay for certain garments and offered orders to manufacturers on a 'take-it-or-leave-it' basis, thereby establishing prices. Monopsony pricing is not a prevalent practice in the Western Canadian industry since it requires the purchasing power of a large buyer and a basic knowledge of manufacturing costs to function effectively.

Product tailoring. Under this method of price determination, garments are so designed that they meet specific prices or rigid price zones. Hence, prices seem to establish the ensuing costs of garments, and the manufacturer's focal point in product tailoring is the predetermined selling price. By working back from this, the particular product components are selected. Often, garments produced for mail order houses, wholesale establishments, and for special sales are product-tailored items designed to be sold at predetermined prices.

Prestige pricing. One garment manufacturer indicated that pricing may be used to lend prestige to a line of garments. Prestige pricing consists of establishing very high prices for some of the better quality garments manufactured in order to upgrade the total product line in the eyes of customers. Garment manufacturers might have no intent of actually receiving orders for any of the prestige items shown, much less producing them. In this case, prices of particular garments are actually established to gain customer acceptance of other style numbers produced by manufacturers.

IV. DISCOUNT STRUCTURES

Types of discounts. The garment manufacturers interviewed follow established trade practices and automatically accept the pricing policy of offering discounts. However, discount structures in the Western Canadian garment industry do not take the form of percentage reductions from gross list prices. In essence, the prices pertaining to particular classes of customers are net list prices. These are calculated so that the accepted trade discounts are embodied in the prices quoted to different classes of customers. Net list prices are designed to distinguish among customers on the basis of the marketing functions they perform (functional discounts), and also by the method of operation on a given plane of distribution. For example, manufacturers, when calculating net list prices for regular wholesalers, may allow a price differential of 25 per cent between the prices paid by independent retailers and those paid by wholesalers. In essence, the list prices so established afford the wholesalers discounts for the functions they perform. In addition, manufacturers may set chain and department store prices at a level 10 per cent lower than those quoted to independent retailers. Thereby discounts are extended to customers on the same level of operation.

Most Western Canadian garment manufacturers use three general price categories, namely, mail order and wholesale prices, chain and department store prices, and retail prices. The number of price categories employed by the firms sampled, however, actually varied from three sets of prices to seven different price categories. The different price allowances granted to customers on the same level of operation are justified by the manufacturers on the basis of the cost of doing business with each of the various types of middlemen. Although no accurate cost records are kept, several large manufacturers are of the opinion that while the small retailers pay higher prices than larger retailers, the small retailers also receive more additional services than the price differential warrants.[11] Thus, it was stated, that while the larger middlemen receive the benefits of trade discounts, nevertheless, they are in reality subsidizing the small retailers. These large middlemen, it was held, do not receive the low prices that would be justified on the basis of the actual costs of doing business.

[11] The opinions of several leading manufacturers are expressed by the words of one member of the garment industry who said, 'the independent retailer receives more services than his relatively high list price warrants.'

V. RETAILERS' ACTIONS

To a large extent, the price limits and margins fixed by retailers' pricing policies determine the upper limits of prices charged by garment manufacturers, and also introduce an element of price rigidity into garment pricing practices. Manufacturers rely on retailers to translate the willingness and ability of the consumer to buy clothing into actual price ranges or price lines. On the basis of the retailers' judgments, especially as exercised by the large retail stores, manufacturers are directed to a predetermined range of price lines for the garments which they produce. Furthermore, once retailers determine these price lines, there is a reluctance on their part to increase prices even in the face of rising costs. As a result, and despite the fact that retailers, in general, are confronted with the necessity of meeting rising costs, they are anxious to maintain both their established mark-ups and price lines. Thus, not only do they introduce rigid limits on garment producers' pricing practices, but they also exert pressures on manufacturers to lower prices in order to satisfy the demands of the established retail mark-ups. In essence then, some retailers assume that garment manufacturers will be flexible in the prices they establish, either at the expense of the manufacturers' own margins or by the reduction of costs, or both.

Increasing margins. Retailers are not only desirous of maintaining margins, but, in addition, attempt to increase them.[12] It was noted in the discussion of price imitation on page 130 that pressure is often applied to garment manufacturers by large retailers to gain price concessions. Such pressures often result in inducing some manufacturers to sell their garments at lower than 'normal' prices for fear of losing sales to competitors. While retailers may achieve larger margins through such tactics, these practices often have adverse effects on the quality of the articles produced and on the stability of the industry as a whole.

VI. COMPETITORS' ACTIONS

Strong rivalry exists among garment manufacturers in Western Canada and the actions of competitors are important factors to be considered in the determination of clothing prices. Following is an examination of the impact of competitors' pricing activities on the prices offered by individual firms in the Western Canadian garment industry.

[12] One manufacturer summed up the situation by stating, 'our market is controlled by a few retailers, but there are many manufacturers. The retailers can increase their mark-ups and squeeze the manufacturers.'

Instigating price changes. Generally, a garment manufacturer becomes concerned when competitors either instigate lower prices, or follow the lower prices which he may set for particular types of garments. Lower price quotations are often initiated by new companies entering the market, established companies introducing new lines, and by the 'cheaper garment houses'. In effect, these prices may only be advanced as a temporary measure by some companies. Despite any temporary intention, however, and the limited productive facilities of the initiating company, such pricing practices have a resounding influence on prices charged by the rest of the industry. It appears that low price quotations often tend to depress the industry price structure in general, and, as one large manufacturer concluded, 'the smaller plants are very big factors in determining prices'. In this respect, however, garment producers are not unique since 'there have been numerous cases in which the impact of new firms added to a general weakness of price to begin with, has precipitated a price reduction'.[13]

Following price changes. Perhaps the facts that most Western Canadian garment manufacturers do not choose their lines and markets carefully, and do not base their price decisions on adequate interpretations of demand and cost information, make them somewhat uncertain of their pricing actions. Such uncertainty can result in extreme sensitivity to the price judgments of competitors (even new firms), regardless of their size or of the quality of garments manufactured. Therefore, it probably intensifies the willingness of garment companies to follow the lower price quotations of other firms. In this regard, one manufacturer stated that 'there is a lack of confidence among our manufacturers . . . they become very secretive and competitive'. Another producer explained that some companies seem to panic when faced with low prices offered by even small producers, immediately take a counter position, and lower their own prices.

The general willingness of garment firms to meet competitors' prices is verified by the results of the survey conducted. More than one-third of the manufacturers interviewed flatly replied that they will always meet their competitors' prices. All of the garment producers indicated that they are at least willing to reconsider and adjust their price quotations. In addition, several large manufacturers agreed that some companies are always ready to produce similar clothing items for a price that is just a shade lower than that of rival firms (one form of imitative pricing). These attitudes and actions imply a belief that price is one of the most important factors

[13] Oxenfeldt, op. cit., p. 198.

in selling garments. However, the manufacturers studied are not certain of the overall effects of price reductions on profits. As a result, most of them were non-committal in expressing opinions on the relationships between price variations and profits. Seven manufacturers did venture guesses concerning the effect of price reductions. Five of them were unanimous in the opinion that lower prices result in lower profits. Two of the largest producers felt, however, that the opposite relationship is the true one.

The results of this study suggest that garment manufacturers in Western Canada believe the demand for their products is relatively elastic. The interviewees emphasized that their own experiences have proven that decreased prices invariably result in increased sales. Therefore, it is not unrealistic to assume that manufacturers would expect to increase their total revenue through the use of lower price appeals. However, while the demand curve faced by individual garment companies is more elastic than that faced by the industry as a whole, to the extent that garment firms follow price reductions offered by a competing producer the latter's demand curve will tend to be more inelastic. In addition, when producers of homogeneous clothing items follow competitors' price adjustments closely, there is a resultant tendency towards more uniform industry prices. This tends to produce demand schedules for individual garment companies which become smaller replicas of the demand schedule of the industry as a whole.

Substitutability of products. The effects of competitors' activities on the pricing practices of individual garment manufacturers vary with the degree of product homogeneity of rival firms. At one extreme are the pricing situations of manufacturers producing garments of perishable distinctiveness, while at the other are the situations of manufacturers producing similar clothing items. Between these two extremities lies the majority of Western Canadian manufacturers, making clothing items that possess varying degrees of perishable distinctiveness and which tend towards homogeneity and substitutability.

Where garment manufacturers produce items that have a desired distinctiveness (e.g. specific style, cloth), they enjoy an opportunity of engaging in premium-margin pricing.[14] Such a situation is a degenerative or perishable one and is governed by the entry into the market of competitors, and the rate of market acceptance of new types of clothing by consumers. Producers of distinctive garments usually have a short-lived period in which to 'skim the cream off the market.' Competing firms enter the field, erase or narrow the gaps

[14] *Supra*, p. 130.

existing between their garments and the distinctive item, and increase the supply of such garments available to demanding customers.

As was previously indicated, most garment companies in Western Canada produce homogeneous or closely substitutable items of clothing, and a relatively high cross-elasticity of demand exists for their products. In view of this, the general hyper-sensitivity of garment manufacturers to the price reductions of competitors, and their willingness to follow such price reductions, can be better understood. It must be remembered, however, that the widespread use of cost-plus pricing tends to give a source of competitive stability to the garment industry, and may offset price sensitivity by affording prices and margins that are acceptable to most members of the industry.[15]

Potential competition. It should be noted that garment producers are not merely concerned with the reactions of existing competitors to their prices, but must also evaluate the response of potential competition. The ease of entry of new firms into the market, and the practicability of diverting the resources of existing manufacturers to the production of most types of garments, intensify the potentiality of new competition. As a result, it may well be that Western Canadian garment manufacturers do not charge the highest prices they can obtain for clothing so as to avert the attraction of an increasing number of competitors. Therefore, the threat of possible competition, as well as the existing aggressive competition, may tend to depress garment prices. It has been written that mature competition in an industry is 'indicated by increasing stability of market shares and price structures'.[16] By these criteria the competitive situation within the Western Canadian garment industry is indeed an immature one.

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[15] *Supra*, p. 128.
[16] Dean, op. cit., p. 411.

A NOTE ON THE CONCEPT OF STOCK

by J. L. MEIJ

1. *Economic and technical stock*

THOUGH the distinction between economic and technical stock is not unknown in business practice it has received little attention in the literature on industrial economics. (In Dutch literature, however, as far as I know, Th. Limperg has introduced the distinction 'economische' and 'technische voorraad' and has drawn attention to its importance.)

Nevertheless the distinction is extremely important for different problems of stock-control.

Technical stock can be defined as the mass of goods — raw material, goods in process, finished goods etc. — actually present in the business's store-rooms, or, as regards goods in process, in the shop.

Economic stock on the contrary is the mass of goods the business has at its free disposal. As a rule it is also the quantity on which the business runs the risk of price-fluctuations.

The following account shows the composition of the economic stock-item for raw material and at the same time indicates the relationship between economic and technical stock.

RAW MATERIAL-ACCOUNT

Technical stock (raw material stored up in the shelves of the business)	Raw material destined for accepted orders
Raw material bought but not yet delivered	Balance: economic stock

Where the distinction between technical and economic stock is actually made, as e.g. in bankers' and stockbrokers' practice, the economic stock is commonly called the 'position'. The serious risk involved in holding stocks of securities easily explains the interest of their holders in the economic stock.[1]

Nevertheless in other branches of business-life a knowledge of the quantity of economic stocks is of practically the same importance. Without a knowledge of the size of economic stock some problems concerned with stock-maintenance cannot even be solved correctly, as will be shown later on.

[1] Usually in these branches daily position-sheets are drawn up showing the business's position in every sort of security. Those sheets are made up of items such as securities on hand, to be received from the stock-exchange, from clients, to be delivered to the stock exchange or to clients, etc.

2. *Different functional and geographical place of economic and technical stock*

First we will draw attention to the different places — functional and geographical — where economic and technical stocks are held respectively.

If we call the sequence of different enterprises engaged in the production of some final good a trade-column, the functional place of a stock can be defined as its place in the trade-column. It is clear that the functional place of the technical stock can differ from that of the economic stock. To put it in other words: the distribution of the technical stock over the various levels of the trade-column can deviate from that of the economic stock; so can the geographical place of both sorts of stock.

Let us first consider the technical stock. In relation to this stock we have to distinguish two parts: a movable and an immovable one.

The process of production will always need a certain quantity of goods available, in final products as well as raw materials. It is not possible to store these goods exclusively at the consumer. From the economic viewpoint they are to be considered as 'in the pipe line'.

The final products in the showroom of a factory or on the shelves of a retail store are good examples of this sort of stock. They enable the buyer to satisfy his wants immediately and in several cases they give him an opportunity to make a choice out of a collection of similar items; finally, they can stimulate the consumer to buy or to buy more than he intended to do previously. It is also clear that it is practically always necessary to have some quantities of raw material and supplementary goods at one's disposal to furnish the process of production. Furthermore, we need stocks of raw material and finished goods in order to avoid the risk of running out.

These stocks cannot be moved from one part of the trade-column to the other. They have their special function in the business in which they are located and they must be held there for the sake of its particular process. We therefore cannot say that there is an economic problem as to the place of this part of the technical stock.

However, we can distinguish another part, a part that has no function with regard to an individual business but only to the column as a whole. In this respect we can think first of all, of inventories originating from seasonal fluctuations in production, in consumption or in both. They can be held in the 'upper' parts of the column, viz. by the producers or wholesale traders in raw material, or 'lower down' by the producers, wholesalers or retail traders of products in a more finished stage.

The factor determining the place in the column is the difference

in costs of carrying stocks of raw material or of finished goods. Generaliy speaking we can say that the storage of raw material is much cheaper than that of finished goods. The first reason in this respect is that a part of the storage costs, e.g. insurance premium, interest of invested capital, is proportional to the value of the stock. Reaching their finished stage goods are rising in value and therefore these storage-costs will rise accordingly. Moreover, finished goods are in most cases more difficult to store; they need well equipped and well-furnished storerooms. Finally, they need much more control than raw material. All these differences in costs of carrying stocks make it profitable not to store more finished product than is strictly necessary to satisfy the direct needs of the consumer.

We may, therefore, draw the conclusion that insofar as the technical stock is movable it will be held in the upper part of the trade-column. As a rule there the carrying costs will be lowest. The carrying of economic stocks, if they are not at the same time technical, only involves risk or uncertainty as to their ultimate selling prices, as we may say following F. H. Knight's distinction in this respect. Therefore we may expect that stocks are economically held where the risk of stock-keeping is lowest.[2]

In practice we can expect the economic stock to tend to be pushed to the lower regions of the trade-column. All forward buying and selling has this effect. In many businesses to a great extent the stocks held are already sold *de facto* but not yet delivered. The raw material held by a factory has already its destination for orders accepted from wholesalers or finishing factories. The latter have placed these orders because they have already received their orders from retailers and consumers. In all 'sell-then-make' business the economic stock held is much lower than the technical one.

A proof of the relatively strong tendency pushing the economic stock downward may be found in the fact that the forward buying contract has as a rule no counterpart that could push the economic stock in the opposite direction.

However it is often said that the storage of finished goods is a more risky business, for those goods have more limited possibilities of use than have raw material or semi-finished products. The more nearly a good reaches its finished stage the narrower is the field of its use.

At first sight this argument is contradictory to the practice stated above. Further reflection, however, leads to another conclu-

[2] According to my opinion we have to distinguish the sacrifices of production in two categories, viz. the costs, i.e. sacrifices that can be calculated in advance and sacrifices that must be considered as a consequence of the uncertainty connected with production in anticipation of future needs.

sion. The different possibilities of using raw material mean only that there is a far more extensive market for such goods than for products in a more finished stage. The broader market does not mean less risk. In practice, as we know, price fluctuations in the markets for raw material are much heavier than those in the markets for finished products. The retail-trade business on the contrary is closely connected with the ultimate consumer. The retailer can make more accurate estimates of what is really wanted. Moreover, the retailer can practice the 'art of selling'. The consumption-scheme is far more elastic than the production-scheme. If an article cannot be placed in the scheme of production the producer will not buy it. The retailer, however, can always try and in many cases with success, to bring it within the consumer's plan.

3. *Two systems of inventory-management compared with regard to order-size and safety-allowance*

Though there are several methods of inventory-management the majority are based either on what is commonly called the two-bin system or on what is known as the order-cycle system.

In the first system the existing stock of a plant is supposed to consist of two parts stored up, as we can say, in two bins. The first part or bin has to cover the demand during the period from the arrival of one order and the placing of the next one, the second part serves to satisfy the demand during the period from the placing of an order to its arrival. We may call this period the delivery-period. The separation of the two bins need not be made visually. The only thing to be done is the fixation of a re-order-level.

The order-cycle system on the other hand determines only the interval of time that may elapse between each placing of an order and the next one, in other words the re-order-period.

It is clear that both systems can be combined with the fixation of an optimum order-size. The difference lies in the way this policy is formulated. Using the two-bin system we can fix the order-size directly. In the order-cycle system we determine the re-order-period in such a way that it corresponds with that in which the optimum order is consumed.

Nevertheless, there is a remarkable difference between the two methods which must be taken into account when comparing both in order to make a choice between them.

Whatever system we are using we must always have a safety-allowance in our stock to protect ourselves against depletion as a consequence of unforeseen changes in demand or in delivery-periods. The effects of both kinds of changes on the safety-allowance are

different in the two-bin system compared with the order-cycle system. Let us first consider the two-bin system.

Increasing demand means a change in the slope of the consumption-curve. The first bin is emptied earlier and therefore the re-order point is reached sooner. After the new order is placed the second bin is worked out before the newly-ordered goods arrive and we must fall back on the safety-allowance.

An increased delivery-period however has not wholly the same effect as the increased demand. Only the stock in the second bin is running out before the new order is delivered. During the time elapsing before the new goods arrive we must satisfy demand out of the safety-stock.

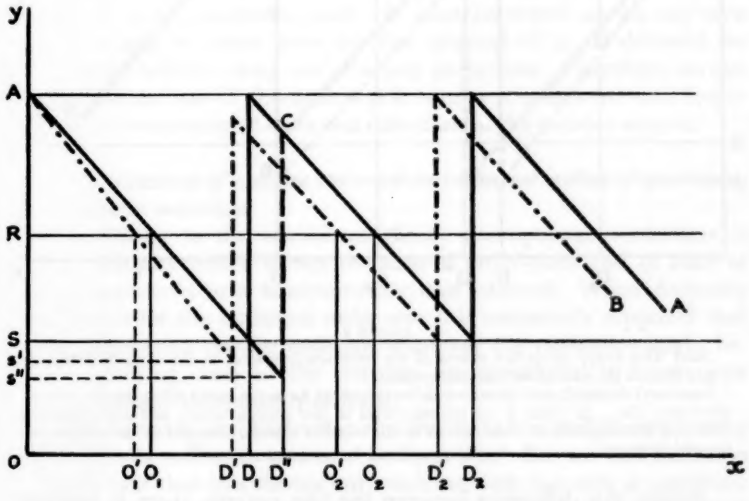

FIGURE 1

Note: The O's represent the order-points, the D's the delivery-points; the solid line AA indicates the original situation, where regularly a quantity SA is ordered at a point O and delivered at D; the dash-dot line AB illustrates the effect of increased demand; the stretched line AC which is not continued further so long as it coincides with AA shows the effect of increased delivery-period.

Increased demand entrenches on the allowance to an amount of Ss', increased delivery-period to an amount of Ss''. (The increase in demand is fixed in such a way that the claim on the safety-allowance would have been Ss'' if the order was not placed at an earlier date.)

The first of the accompanying graphs illustrates the difference in effect of both facts quite well. In the case of increased demand we do not need to entrench on the safety-allowance in the same degree as if the delivery-period increases (see Fig. 1). The fact that the re-order-level

is reached sooner in case of increased demand in effect stretches the safety-allowance. Under the order-cycle system the effect of increasing demand is the same as of increased delivery-period. Here there is no mitigation due to ordering earlier in the case of increased demand.

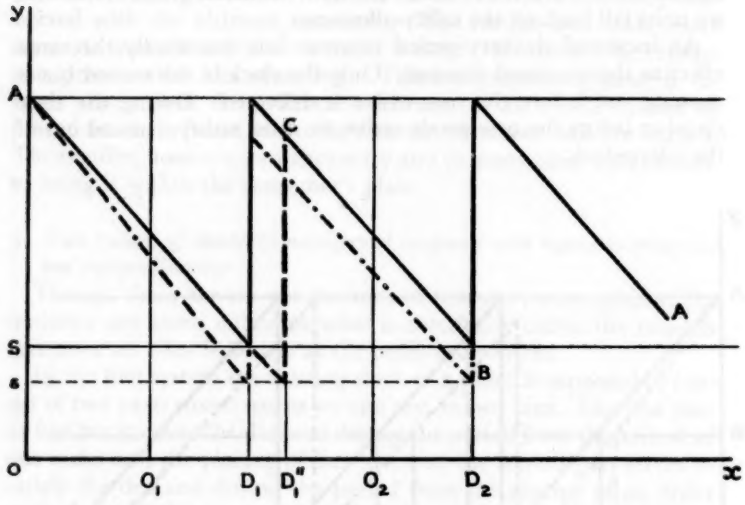

FIGURE 2

Note: This graph gives the effects of the order-cycle system in the same situation as Fig. 1 does in the case of the two-bin system.

Increased demand and increased delivery-period have the same effect on the safety-allowance (Ss). As there is no re-order-level in this system, order- and delivery-dates (O's and D's respectively) are not, as in the two-bin system, changed in the case of increased demand.

Besides this difference between the two systems, there is another regarding the restoration of the safety-allowance. If the increasing of demand and the increasing of the delivery-period are temporary — e.g. for one consumption-period — under the two-bin system the safety-allowance is restored automatically as the first graph shows. The first bin acts as a sort of regulator that always restores the safety-allowance.

However, this is not true under the order-cycle system. Here we must state that when demand is back to its former intensity the safety-allowance still remains on a lower level. It can only be restored by ordering a larger quantity at the next re-order date. In the case of a temporarily increased delivery-period the safety-

allowance is, as under the two-bin system, automatically restored after the arrival of the next order.

Thus we may conclude that increased demand has a different effect on the restoration of the safety-allowance under the order-cycle system as compared with the two-bin system; increasing the delivery-period has not. In the case of the two-bin system the safety-allowance is below its normal level during the delivery-period of the new order ($O'_1D'_1 = O_1D_1$ in Fig. 1). Under the order-cycle system it is below that level during the delivery-period of the new order plus its consumption period (O_1D_2 in Fig. 2). Thus the safety-allowance has to cover the effect of increased demand during a longer period. Therefore it must be larger than under the two-bin system.[3]

The safety-allowance must be applied to the technical stock as well as to the economic stock. It must be stored up on our own shelves and we must have the free disposal of it. If destined for accepted orders it does not give any protection. Therefore, we can say that the use of the order-cycle system is connected with larger sacrifices consisting of costs and risks than in the two-bin system.

4. *The behaviour of economic stock and the traditional method of determining optimum order-sizes*

According to the traditional theory the optimum order-size is that quantity which brings the sum of order-costs and of costs of carrying stocks to a minimum per unit ordered. When deducing formulae for the optimum order-size it is commonly supposed that the order-costs remain constant whatever the order-size might be. The carrying costs on the contrary are considered to increase in proportion to the quantity ordered.[4] [5]

We do not intend to develop this theory as it is well known among theorists as well as in practical business life.[6] But we call attention to the fact that this theory only reckons with two sets of sacrifices, order-costs and carrying-costs, and not with the risks concerned with the economic stock. Therefore it only holds good if the economic stock is reduced to zero and therefore can be completely disregarded. This, as can be easily understood is, though not impossible, nevertheless very unlikely.

[3] The fixation of safety-allowances is beyond the scope of this article. See for an acceptable procedure Th. M. Whitin: *The Theory of Inventory Management*, Princeton 1953, p. 42 and further. Whitin states correctly that in the fixation of the safety-allowance under the two-bin system one must reckon with the delivery-period (lead-time); under the order-cycle system with lead-time and review period (=consumption-period).

[4] In case of production the optimum lot-size can be determined in the same way.

[5] It is further supposed that the average amount of stock always is half the optimum order-size (the safety-allowance not included).

[6] A lot of formulae for different circumstances can be found in: Thomas M. Whitin, p. cit., Chapter 3 and several other works on stock-management.

In order to show the influence the economic stock can have in this respect we suppose that no transactions are made in future markets and that forward selling is not practiced.

Under this supposition it is clear that the economic stock is always larger than the technical one. The economic stock is at its maximum just after the moment an order is placed and at its minimum just before that moment. Thus the economic stock fluctuates between the order-points, the technical one on the contrary fluctuates between the delivery-points.

As it is necessary that a new order is placed at the moment the economic stock just covers the needs during the period of delivery, we can say that the minimum economic stock must always cover the needs of this period and the safety-allowance. The maximum of course is equal to the minimum increased by the amount ordered. Thus the order-size also determines the amplitude of the fluctuations of the economic stock.

The order-size need not cover the demand during the delivery-period or more as was supposed in our diagrams 1 and 2. Fig. 3 gives an illustration of a case in which the optimum order-size covers a one-month demand but the delivery period is five months. Therefore it is right that the optimum-size in the traditional theory is determined independently from this period.

It is not correct, however, that the optimum order-size may be determined without reckoning with the risks involved in carrying the economic stock. Though its minimum cannot be reduced as it is fixed by the delivery-period its maximum might be diminished by ordering a smaller quantity.

However, deviation from the optimum order-size as it is commonly fixed means increasing the sum of ordering- and carrying-costs. Therefore if we wish to reduce the order-size below its optimum we have to compare diminishing risks with increasing costs, or, to put it in other words, we have not to determine the minimum of the sum of two variables, ordering-costs and carrying-over costs, but to fix the minimum of three variable items, ordering-costs, carrying-over costs and risks of economic stock. It is an advantage of the economic stock-concept to focus our attention on this.

We now turn to another point. As we have stated already the economic stock always covers the demand during the delivery-period whatever the optimum order-size might be. If the optimum size is lower than the demand during the delivery-period, as illustrated by diagram 3, we must place new orders before the former are delivered.

Large delivery-periods and small order-sizes therefore give rise to substantial economic stocks as compared with the technical stocks which are determined only by the order-size, the question of the safety-allowance being put aside for the moment.

However, the economic stocks fluctuate within narrow limits as a consequence of the small order-size.

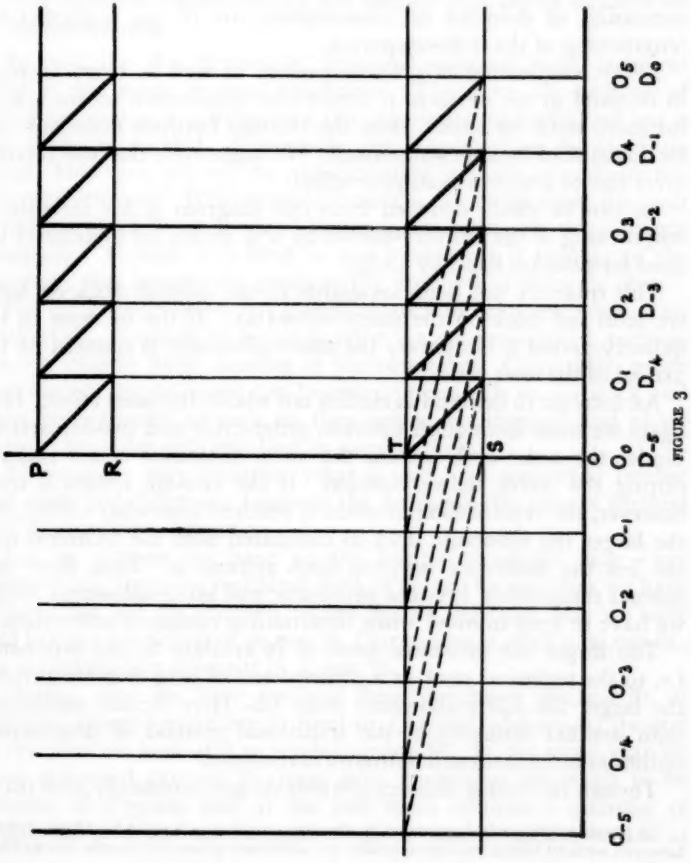

FIGURE 3

Note: As in the former graphs the O's are order-points and the D's delivery-points. The orders O_{-5}, O_{-4}, etc., in the left quadrant are delivered at the points D_{-5}, D_{-4}, etc., in the right one. ST being the order-size, the economic stock, apart from the safety-allowance, fluctuates from SP to SR, that is between six and five times the order-size.

The value of lowering the risks of economic stock can become practically negligible in those cases and then the traditional theory seems to hold good notwithstanding its leaving out the question of economic stock.

Nevertheless, there is still another side to the economic stock-problem. It concerns the safety-allowance.

As we know, the function of the safety-allowance is to protect against the danger of running out as a consequence of an unforeseen increasing of demand or consumption, or of an unpredictable lengthening of the delivery-period.

Every lengthening of delivery-periods as well as every increase in demand at the moment it comes into appearance means a need for more stock on hand. Here the relation between economic and technical stock becomes important. We might state that this relation gives rise to a sort of multiplier effect.

As can be easily deduced from our diagram 3, for instance, a lengthening of the delivery-period by x% means an increase of the need for stock on hand by 5.x%.

This quantity not being available in the normal stock on hand we must fall back on the safety-allowance. If the increase in the delivery-period is temporary the safety-allowance is restored by the arrival of the next order.

An increase in demand again has not wholly the same effect. Here again we must distinguish between order-cycle and two-bin system. Under the order-cycle system the safety-allowance is not restored during the whole delivery-period. If the two-bin system is used, however, the replenishing moment is reached somewhat earlier, but the larger the economic stock as compared with the technical one, the less the difference between both systems is. Thus there is a mutual relationship between order-size and safety-allowance which we have to keep in mind when determining optimum order-sizes.

The larger the economic stock is in relation to the order-size, i.e. to the technical stock as a consequence of long delivery-periods, the larger the safety-allowance must be. Here we are confronted with another difficulty of the traditional method of determining optimum order-sizes and optimum inventories.[7] [8]

Though increasing delivery-periods do not necessarily give rise to

[7] A purely mathematical argument for the same conclusion is given by Th. R. Whitin, however, without taking into consideration the difference between economic and technical stock.

[8] In the traditional theory it is always supposed that order-costs and carrying-over costs relate to the same quantities. That, however, is not always necessary as in many cases goods can be ordered in large quantities, to be delivered by instalments. Here, too, we have to compare the additional risk related to the increased economic stock with the diminishing of the order-costs.

larger order-sizes they are the cause of enlarging inventory-risks. First they enlarge the economic stock, apart from the safety-allowance, proportionally to the lengthening of the delivery-period. Moreover they multiply the effects of deviations in delivery-periods and in demand on the needs for stock on hand and therefore ask for larger safety-allowances.[9]

5. *The distinction between economic and technical stock and the valuation for the balance-sheet*

In practice the distinction between economic and technical stock is not made in most companies. Therefore, the problem of valuation and as a consequence the calculation of profit and loss is not correctly tackled. Commonly one is evaluating the stock on hand. However, is it not the technical stock we have to evaluate but the economic one. If the technical stock is not at the same time our economic stock it no longer belongs in an economic sense to our company. Though it is held in our storerooms it belongs to the company that bought the goods or the products to be made of it.

For the balance-sheet this technical stock in economic sense is no stock at all. It would be better to say it is a not-yet-expired, perhaps not yet exactly fixed, liability of our customers. Conversely, goods that are not yet delivered can belong economically to our stock and must be evaluated as such, as they are at our disposal and as we have to bear the risks involved in owning them.

An example may illustrate what is said here somewhat further and show the difference between the economically correct method and the traditional practice.

Let us suppose we have at the beginning of the year — say January 1st, 1955 — a technical stock of 60,000 lb. and that we have ordered but not yet received 10,000 lb. At the same date we have sold but not yet delivered 30,000 lb. Our technical stock is 60,000 lb., the economic one amounts to 40,000 lb.

During 1955 we have received from purchases 260,000 lb. at different prices amounting in total to £62,000, whereas, at the end of the year we have still to receive 20,000 lb. In the same year we have delivered 250,000 lb. from sales at various prices up to an amount of £75,000 and at the end there remains a quantity of 24,000 lb. sold but not yet delivered. As can be easily verified at

[9] Of course it is a matter of fact that the safety-allowance will be larger the longer the delivery-period is. What we had in mind in this article was not only the influence of the delivery-period as such but of the relation of the delivery-period (i.e. the economic stock apart from the safety-allowance) and the order-size (i.e. the technical stock apart from the safety-allowance) to the safety-allowance.

the end of the year the technical stock is 70,000 lb. but the economic one amounts to 66,000 lb.

The price at January 1st, 1955, is 5s., and at the end of the year 5s. 6d. A trading account on the traditional method would show the following figures:

TRADING ACCOUNT FOR THE YEAR 1955

	£	s.	d.		£	s.	d.
Balance 60,000 lb., 5s.	£15,000	0	0	Sales 250,000 lb.	£75,000	0	0
Purchases 260,000 lb.	62,000	0	0	Balance 70,000 lb., 5s. 6d.	19,250	0	0
P/L account	17,250	0	0				
	£94,250	0	0		£94,250	0	0

How do the figures of this trading account change if we introduce the concept of economic stock?

At the beginning of the year we have an economic stock of 40,000 lb. We have purchased 270,000 lb. (260,000+20,000−10,000) whereas sales are not 250,000 lb. but 244,000 (250,000+24,000−30,000).

We can now — supposing the article is bought and sold at various prices — set up the new trading account as follows:[10]

TRADING ACCOUNT FOR THE YEAR 1955

	£	s.	d.		£	s.	d.
Balance 40,000 lb., 5s.	10,000	0	0	Sales 244,000 lb.	73,500	0	0
Purchases 270,000 lb.	65,000	0	0	Balance 66,000 lb., 5s. 6d.	18,150	0	0
P/L account	16,650	0	0				
	£91,650	0	0		£91,650	0	0

As can be easily understood the profit calculation may show very different results according to whether one has based that evaluation on the economic stock or on the technical one.

[10] The specification of purchases is as follows:

	£	s.	d.
260,000 lb. received in 1955	62,000	0	0
10,000 lb. from 1954, 5s.	2,500	0	0
	59,500	0	0
20,000 lb. not yet received in 1955, 5s. 6d.	5,500	0	0
	65,000	0	0
of sales:			
250,000 lb. delivered in 1955	75,000	0	0
30,000 lb. from 1954, 6s.	9,000	0	0
	66,000	0	0
24,000 lb. not yet delivered, 6s. 3d.	7,500	0	0
total sales in 1955	£73,500	0	0

These differences result not only from the different amount of economic and technical inventory at balance-sheet date respectively but also from the fact that the purchases and sales consist of other amounts than if we are reckoning with the technical stock only.

We can explain the difference best by saying that the economic-stock concept forces us to reckon with what is really bought and sold and not with that which is received in any year. We can draw here a parallel with another difference in accounting practice more familiar to most of the readers, viz. that between the account of receipts and expenses, the cash-account, and the profit- and loss-account. In the profit- and loss-account we have figured all receipts and expenses to be considered as profits and losses of the ending year whether they have been effectuated in that year or not. In the cash-account on the contrary we have only to do with receipts and expenses whether they are profits and losses or not.

In the traditional trading account, working with the technical stock-concept, we are calculating from the completed sales and purchases, while, using the economic concept, we calculate the sales and purchases relating to the ended year whether they have been completed or not.

In a going concern these differences can be counterbalanced in the successive years just as if we would postpone the profit-and-loss account until the company's end, its final liquidation.

In this latter case the profit-and-loss account is the same as the cash-account. Nevertheless it is important to impute profits and losses to the period in which they arise. Therefore we make a P/L account periodically.

For the same reason we must employ the economic stock-concept.[11]

6. *The distinction between necessary and speculative stock compared with that between economic and technical stock.*

It seems important to raise the question whether the necessary or— as it is said in Dutch and German literature — iron stock is related to the economic or the technical stock conception.

As the reader knows, modern evaluation practices as 'lifo', 'nifo' or replacement valuation try to prevent profit-calculations on necessary stocks. Those stocks always must be replaced and therefore a

[11] Some years ago the fiscal authorities of the Ministry of Finance of the Netherlands declared they would accept – under certain strictly defined conditions – profit and loss calculations on a lifo – basis. Hitherto the fiscal authorities only accepted profit and loss calculations on a fifo or other historical basis. The question then was raised whether the economic or the technical stock was to be taken in account. The problem was solved by the Ministry by a sort of 'Solomon's judgment'. The tax-payer was free to make his choice for the technical or for the economic stock, but once his starting point had been fixed, he could not alter it in following years.

genuine profit could never arise as a result of rising prices. But what is a necessary stock? Here a confusion arises as a consequence of neglecting the difference between economic and technical stock.

Commonly the question mentioned above is answered by saying the necessary stock is that which is needed to keep production on its normal level or something like this. What the company holds more is speculative. Here we have the confusion in 'optima forma' and it is clear that we need a technical stock in order to further the processes of production but that in order to speculate we need only an economic stock.

In my opinion we have to consider the fact that there are at least two concepts of 'iron' stock to be distinguished. First there is a stock necessary to satisfy the consumption or the demand of one delivery-moment to the next one, including a safety allowance. We must have that stock put up on our shelves for otherwise we cannot continue producing or selling. In this function the iron-stock concept relates to the technical stock. It does not seem necessary, however, that this stock should be at the same time an economic one. We might already have sold the whole technical inventory. In the case of evaluation for the balance-sheet we must consider quite a different 'iron' stock. At this moment as we have already said we have only to reckon with the economic stock; the economic stock indicates what the company really possesses or its position at the moment of evaluation.

If we wish to calculate profits only on surplus stocks we must divide not the technical but the economic stock into two parts. The first one being the iron or necessary economic stock, the second the surplus stock. According to lifo, nifo or replacement-valuation, the necessary economic stock cannot show a profit or a loss. It is clear that necessary economic stock cannot be understood in the same way as the technical one.

If we do not wish to speculate in inventories we must try to hold the economic stock on a minimum level. The best position, therefore, seems to be this one in which the economic stock is zero. Then the company has no risks whatever to bear. However, it is not always possible to reduce the economic stock to zero. It depends on the extent to which it is possible by means of forward selling to push the economic stock to lower levels of the trade-column. The necessary economic stock therefore consists of that part of the economic stock that cannot be reduced further. If a business-man does not wish to speculate he must try to reduce his economic stock to the lowest normally possible level. That is to say that he is not obliged to use forward selling if this method does not belong to the normal practice

in his branch. Forward selling in a branch where this practice is unusual would mean accepting extremely low prices in order to force down the economic stock. That would be quite unrealistic. Thus we have determined the level below which no profit can be got from stock, the no-profit stocklevel.

However, it is clear that the economic stock cannot wholly be reduced to zero even if we practice the 'sell-then-make' system. The safety-allowance can never belong to the technical stock only. If we have sold the whole stock including the safety-allowance the latter does not give any protection. A company only producing goods already ordered cannot maintain its own delivery-terms if it has no reserves of raw materials at its disposal. Producing for stock and selling out of it the business must have a safety-allowance in finished goods, too.[12]

7. *Conclusion*

Our considerations lead to the conclusion that the distinction between economic and technical stock must be integrated in the theory of industrial economics as a valuable element in the solution of different problems concerned with stock-keeping.

Without this distinction several questions cannot be solved in a satisfactory manner. As we have pointed out we have to consider not only the technical but also the economic stock in problems relating to inventory-management. Further we must evaluate the economic stock for the balance-sheet and for the periodical calculation of profit and loss.

With these two points we have not yet touched all the problems for which the distinction is significant. For instance we may call attention to the problem of stock behaviour in business-cycles developed by several economists, such as Keynes, Metzler, Abramowitz

[12] Sometimes it is argued that the economic stock can be reduced to zero by trading in future markets. If we have a positive economic stock we can place a sale of the same quantity in the future market and compensate for the risk involved in our inventory-position. At first sight it seems clear that such compensation can only be got for goods being dealt in in future markets. They form only a small part of all articles being traded. But even in such relatively scarce categories of goods compensation is not always possible and even then not without danger. We cannot treat this subject extensively in this article, the subject being a problem by itself and beyond the scope of our present considerations. We can only indicate that one of the principal conditions for actual compensation of the risk of economic stock lies in the requirement that the difference between the spot and the future quotations must be equal to the costs of storing. This condition is not always fulfilled.

Moreover the risk compensation is not without danger for the liquidity of the company. It is clear that if the compensation is effective losses in actual stocks are compensated by gains in future transactions whereas, on the other hand, gains on actual inventory are counter-balanced by losses in the future market. Meanwhile the gains on actual inventory cannot be considered as profit for they are necessary to finance the replacement of that stock. The losses in the future-market, however, must be paid out.

and many others. Here too, a clear distinction must be made between the behaviour of economic and technical inventories.

It is beyond the scope of this article to pay further attention to this problem. Nevertheless, at first sight it is clear that the behaviour of economic inventories in the trade-cycles is more important than that of technical stocks.

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FURNITURE FOR THE MASSES — A COMMENT

Note: The editors have received the following comment on Mr. Morrell's article, which appeared in the November 1956 issue, from an economist on the staff of a large furniture manufacturing company.

THE conclusions which Mr. Morrell reaches in his paper are, generally speaking, true of a fairly large proportion of furniture retailing. There are, however, certain tendencies which offset this to some degree. In recent years a number of large furniture manufacturers have taken to branding their merchandise and fixing a retail price for it in their advertising. This, of course, means that in their case the same product is, in general, sold to the public at the same price in all the shops and the public can compare values and can calculate the hire-purchase charges. Moreover, a high proportion of furniture is sold on a retail mark-up of between 40 and 45 per cent and only rarely does the figure reach as high as 60 per cent.

It is true, however, that price comparisons or value assessment are particularly difficult in the case of furniture and, of course, being an article which is only bought infrequently by the public, its value is very rarely accurately assessed. As Mr. Morrell has stated, a large number of shops are more interested in selling hire-purchase and credit terms than they are in selling furniture, though it would be wrong to say the majority of furniture is sold in this atmosphere. In this connection it is interesting to point out that in general post war retail practice shows an improvement over pre-war and generally the rate of mark-up is less, particularly on merchandise bought on hire purchase.

The point that Mr. Morrell makes about the wish of the retailer to have in his shop window products that are different from those appearing in the window of his competitors is a fact of which the manufacturer is only too aware. It results in the manufacturer having to make a wider range of products than he would wish and to change them more frequently, thus increasing the cost of his products to the retailer and ultimately to the consumer. A most interesting question at the moment is whether branding is going to extend and whether this will solve some of the manufacturing problems and whether the public will realize on an extensive scale that this enables them to assess and compare values more accurately. In many cases the retailer does not like branded merchandise because he says it increases the size of stocks which

he has to hold and, of course, fixes the prices at which he must ultimately sell to the consumer. Some manufacturers see the wider development of their own brands as the answer to many of the points that Mr. Morrell raises. Up to the moment branding, of course, has only applied to medium and higher priced furniture and mostly in the contemporary-style field. It is likely that in the manufacturing sphere the larger firms will continue to take an increasing share of the market; providing monopolistic tendencies do not creep in, and providing branding is continued and extended, it would appear that in the long run the public will be in a position whereby many undesirable retail practices mentioned in Mr. Morrell's article will cease to influence them.

There appears to be an inaccuracy in Mr. Morrell's comments on hire-purchase restrictions on page 28. From the end of 1952 until February 1955 furniture was free of all hire-purchase restrictions. Mr. Morrell would appear to indicate that it was not until July 1954 that these restrictions were removed. This is, however, a minor point and does not invalidate the thread of Mr. Morrell's argument.

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LETTERS PATENT FOR INVENTIONS: THEIR USE AND MISUSE *

by G. A. Bloxam

INTRODUCTION

One of the landmarks in the transition of this country's economy from the feudal to the capitalist was the Statute of Monopolies of James I. This Statute rendered void all grants of monopolies and dispensations with one exception. The exception was the grant of 'letters patent . . . for the term of 14 years[1] . . . of the sole working or making of any manner of new manufactures within this Realm to the true and first inventor and inventors of such manufactures which others at the time of making such letters patent and grants shall not use, so as also they be not contrary to the law or mischievous to the State by raising prices of commodities at home or hurt of trade or generally inconvenient'. The letters patent referred to in the Statute of Monopolies is the direct ancestor of the present-day letters patent for inventions.

The basis of the grant is that the 'manner of manufacture' is new and would not be introduced into the country were it not for the agency of the inventor, so that by granting a monopoly of limited duration to the inventor the practice of the manufacture is not restricted, but on the contrary, encouraged. Nevertheless, the Statute expressly provided that the grant must not (to use modern terminology) be in restraint of trade and this proviso is embodied in a detailed form in the patent law which is operative at the present time.[2]

Like other British institutions, letters patent for inventions (referred to for short as patents) have evolved, both as to their nature and their uses, out of all recognition from the days of James I, but the foundation remains. Patents are still monopolies of limited duration to encourage new manufactures, and the patent law is still concerned to prevent abuse of such monopolies. But the development of the economy has given rise to a tendency towards the formation of monopolies quite different from those created by patents. This tendency has become so marked as to give rise recently, for the first time since the Statute of James I, to counter-legislation. A brief reference to the latter is necessary to complete the background of the

* The author wishes to acknowledge the valuable assistance he received from his colleague, Mr. H. W. Grace, in the preparation of the article.

[1] Now 16 years.

[2] The Patents Act 1949.

present article, although any detailed consideration would be outside its scope.

The first of these recent enactments was the Monopolies and Restrictive Trade Practices Act 1948, which is concerned with situations in which a third or more of a particular trade is in the hands of a single company or group, or of a collection of companies bound together by some agreement or arrangement. Under this Act the Monopolies and Restrictive Practices Commission was set up to investigate such monopolies and condemn practices that they considered to be against the public interest.

The Restrictive Trade Practices Act 1956 is concerned with agreements between autonomous companies or persons and specifies in relation to such agreements certain restrictive practices which are presumed to be against the public interest, typical of which is the collective enforcement of resale price maintenance. The Commission formed under the 1948 Act, now re-named the Monopolies Commission, remains to deal with monopolistic practices, for example by individual firms or groups. It is interesting to note, however, that in one respect the new Act considerably improves the position of an individual firm or group, in that it permits such individual to enforce resale price maintenance in the Courts. To this extent, therefore, the Restrictive Trade Practices Act might encourage the merging of independent companies.

This article is written by a United Kingdom practitioner, and will deal primarily with the situation in the United Kingdom, but since the Journal appears on both sides of the Atlantic, comparing and contrasting references will be made, where appropriate, to the United States. It should be assumed, therefore, that the text refers to the United Kingdom unless otherwise stated, and this applies, of course, to the legislation just referred to. The general position with regard to monopolies is quite different in the United States where, broadly speaking, any restriction of competition is illegal under the Sherman and Clayton Anti-trust Acts and is, moreover, subject to penalties.

I. THE NATURE OF A PATENT

The legislature has permitted the Crown to grant a monopoly for a limited period (16 years) to an inventor in return for his introducing his invention into practice in the Realm. It is convenient to think of the patent grant as analogous to a contract between the Crown and the inventor. In return for fully disclosing his invention in a patent specification so that others may use it at the expiry of the patent, the

Crown grants the inventor the sole right to 'make, use, exercise and vend' the invention. This is subject, it should be said, to one provision which is important nowadays when the Crown and its contractors can be heavy users of a patented invention: by Section 46 of the Patents Act the Crown may use a patented invention without reference to the patentee, but the latter then has a claim against the government for compensation.

It is impossible to understand the uses and misuses of patents without a clear understanding of the precise nature of the right granted to the patentee by the Crown. It is a piece of property, but not the sort of property that can be enjoyed by its use, such as a house or a motor car. It is the sort of right which lawyers call a '*chose-in-action*', that is, a right to sue others in the Courts. Using the patent right is not the same as using the invention the subject of the patent. The patent does not give the patentee (or anyone else for that matter) the right to enjoy the use of anything, but only the negative right to prevent others, by due process of law, from enjoying the use of the invention. The patent must therefore be thought of rather as a fence erected around some desirable piece of property than as the property itself.

But what is an invention? By the definition in the Patents Act it must be a 'manner of new manufacture'. In the days of the Statute of Monopolies this no doubt meant an entirely new trade, for example, the making of clocks or of stained glass, but it has gradually come to mean any process of manufacture, or even an individual step of such a process; and, by a further extension, a manufactured article or machine or even a component of such an article or machine. Clearly a monopoly in the use of just one specific process or the manufacture of just one design of article or machine would be of no value because it could be evaded by trivial alterations. There has, therefore, grown up the practice of permitting the patentee to define the scope of his monopoly in terms broader than the individual process or apparatus he has actully reduced to practice. What he is allowed to do, roughly speaking, is to make the monoply he is claiming[3] coterminous with the most general form of solution he can devise of the problem to which his new process or apparatus relates, but always with the proviso that his claim must in form be for a manner of manufacture, i.e. a process or an apparatus. In other words, the claim must be in such terms that it can be enforced by the Courts in the following form: 'You may not use or make the process or apparatus (or any of them) defined in the patentee's claim'. Clearly the Courts could not order

[3] The claims of a patent specification are the part of the document which delineates the scope of the monopoly grant to the patentee and not, as is sometimes supposed, a statement of the advantages which the patentee may claim for his invention.

any one to refrain from solving a problem by any means whatever and much of the skill of the patent draughtsman lies in deciding just how broadly he can claim an invention, while still keeping it within the framework of a new process or apparatus rather than merely a statement of a problem.

It has been mentioned above that an alleged invention, to be patentable, must be new. Not only must it be different from what is already known, but the difference must be something which would not have been obvious to the average person skilled in the art to which the invention relates. The patent draughtsman is therefore concerned to ensure not only that his claims relate to a process or apparatus rather than an abstract idea, but also that they shall not be so broad as to embrace processes or apparatus which differ only in an 'obvious' way from what was known before.

An important characteristic of the patent grant is that it can be revoked at any time by the High Court on the ground that the grant of the patent was invalid. For example, the Courts may hold that what the patentee has claimed is not in fact a manner of manufacture, or was not new or unobvious at the relevant date. People sometimes wonder why these matters are not taken care of by the Patent Office whose officers examine every patent application and are empowered to withhold the grant of a patent. The answer is twofold. Firstly, the duties of the Examiner are carefully limited to matters which, broadly speaking, do not involve consideration of evidence outside the documents available to him; thus, for example, the Examiner is precluded from taking at all the question whether an alleged invention is 'obvious' or not.[4] Secondly, even with regard to the matters which may properly be considered by the Examiner, he may not have access to all the relevant information. For example, there may be a description of the invention in a prior document which is outside the range of the Examiner's search.

Thus a patent may be assailed in the Courts and there is a substantial chance that it may be held invalid on one or other of the grounds laid down in the Patents Act. But the patentee has a further hurdle to jump if he is to bring to book a supposed infringer of his rights. He has to show that what the alleged infringer is doing is within the scope of his patent claims. This is not only a matter of fact (i.e. of what the infringer is actually doing) but also how widely the patentee's claims should be construed. The net result of all this is

[4] The United States law differs here from ours. In the United States the Examiner's duty is to allow the grant only of patents which he considers to be valid, i.e. he can take into account every possible objection to the validity of the patent. The granted patent is, however, subject to review in the Courts and it is significant and perhaps surprising that on the whole more American patents than British are held invalid by the Courts.

that nobody can be certain before the case is actually heard in the Courts what is the extent of the patentee's rights, or whether he will be able to enforce them. Moreover, the degree of uncertainty is rather higher than in most other branches of the law because of the inherent difficulty of the technical subject-matter to the unscientific Judge,[1] and the great number of complex legal issues involved in relation to the extent of the case law.

II. HOW PATENTS ARE USED

(a) *As Monopolies Restricting the Use of the Invention to the Patentee*

We have mentioned that the concept of 'manner of manufacture' of the old Statute of Monopolies has been gradually broken down to include small constituents of a whole manufacture. This tendency has been intensified over the past 50 years with important results in the practical use of the patent system. The effort spent on technical advance has increased enormously in volume in recent years. This means that relatively minor improvements are being made all the time at a high frequency instead of relatively major improvements at a lower frequency. Each improvement is likely to be only a small part of, for example, a chemical process or of a new machine or electronic apparatus and a patent for such an improvement, however important the latter may be, is likely to be weak from the two points of view of the degree of invention involved and the possibility of proving, as a matter of fact, that a competitor has made use of the improvement. A complete new process or apparatus can hardly be hidden, but a small component can. Again, looked at as an advance in comparison with the general welter of progress, the improvement is less likely to show up as an unobvious one than if it stood out as an isolated improvement in a relatively static art.

The objective of the research and development resources of a firm is the production of a new or improved product or method of making an existing product. It cannot risk deferring patenting the accumulation of improvements until the complete new process or product emerges. It has to guard against premature disclosure or publication, or patenting by a third party. The tendency is therefore to cover every minor improvement individually and the result is the substitution, so to speak, of quantity of patents for quality.

The outcome is that the policy of firms in the more progressive fields of manufacture is to patent every improvement which is relevant to the firm's activities and which can be patented at all,

[1] Now mitigated, so far as the court of first instance is concerned, by the appointment of a Special Judge for patent actions.

without giving overmuch thought to the question of validity or to whether the improvement will ultimately find a use or not. This tendency is self-propagating. If firm A is patenting everything it can, firm B must do the same, firstly to keep abreast in this sector of the competitive race, and secondly defensively in order to maintain its freedom to use its own improvements. There is always a danger that B may acquire a patent which would stand in the way of A's future activities in respect of an improvement which had actually been first made by A. There are two ways of preventing this. Publication of the invention by A would prevent B from getting a patent applied for after the date of publication. Alternatively, A may itself apply for a patent and this will take the priority of its own date of filing. The latter course, although an inefficient way of using patents, is generally preferred to the former, firstly because early publication may be contra-indicated on grounds unconnected with patents, secondly because publication is not an absolute safeguard in the United States and Canada, and thirdly because the patent may have its use as a patent monopoly in addition to providing some assurance that the patentee will have freedom to use his own invention.[6]

In the result a firm with a thriving research and development department acquires a vast number of patents, most of which will be of small significance. What is the value of this accumulation of patents to the firm? The answer is to be found partly in the characteristic nature of the patent right: it does not operate except as a preventative, and is a weapon of defence rather than offence (the word 'defence' is used here in a different sense from the 'defensive' patenting referred to above. Here is meant the proper use of the patent to give the patentee a monopoly, as distinct from the inefficient use of the patent as a means of maintaining freedom to use the patentee's invention as against a third party). In the last resort the preventive action can only be enforced through the Courts, but the expense and uncertainty of patent litigation are great deterrents (a deterrent which is greater the greater the technical development of the art in question) with the result that a patent operates nearly always as a weapon of passive rather than active or aggressive defence. If, therefore, a firm succeeds in surrounding a new development with a web of relatively small patents this may provide as good a defence for it as one master patent for a substantial part of the whole process or apparatus. The very complexity involved in challenging such a 'web' would daunt a would-be trespasser. In this connection

[6] It should be noticed, however, that the patentee has not got absolute certainty that he will be free to use his invention as against a third party, but the reasons for this are too technical to explain in this article.

it should be noted that there is no relation between the effectiveness of a patent and the complexity of the invention and its description in the patent specification. We are, indeed, hypothecating that the art is one of technical complexity and it frequently happens that a small improvement requires a great deal of background and foreground explanation in the patent specification.

The tendency described above is commonly expressed by saying that firms tend to respect each other's patents. If it were not so and firms were obliged to take aggressive action, they would find their patents a less effective weapon: each patent would have to be taken singly and the mutually supporting effect of a web of patents (often called a 'patent situation') would be lost.

There are exceptions to this trend. An interesting one is the patenting of ball-point pens. Here one firm obtained patents for certain improvements which are of decisive importance relatively to this comparatively simple article and has used them aggressively by adopting, it would seem, a policy of suing recalcitrant infringers. This is a contemporary illustration of the classical use of patents. In the more complex fields important inventions do arise occasionally, but the great majority are small in relation to the ultimate process or article under development.

The trend discussed above has been developed to a fine art in the United States despite the fact that patents are harder to get there. The 'defensive' patenting undertaken to preserve a firm's freedom to use its own improvements is more necessary in the United States than here, because publication will not prevent an inventor who can prove an earlier date of invention from obtaining a patent if he applies within one year after the publication. It should not be thought, however, that because patents in the United States are harder to get a greater proportion of those that are litigated are held valid because in fact (as indeed was noted on page 160) the opposite is probably true. Patents do tend to be respected in the United States of America, but for the same reasons as operate in this country.

How far is the system as it now appears to operate beneficial or otherwise to the general public? Nothing so far described can be regarded as a misuse of patents; misuse, which is described later, is *ex hypothesi* harmful to the public interest. The question we are asking here is whether the proper use of patents as it has developed in the era of intensive technological development is beneficial. As indicated above, the original and continuing basic purpose of the patent system is to encourage new manufactures by the grant of monopolies of limited duration. This is bound up with the disclosure of the invention to the public in the patent specification. A manufacturer may

devise and operate a new process in secret and may thus secure an effective monopoly so long as he can maintain his secrecy. One object of the patent system is to discourage secret working by giving the inventor of the new process a monopoly for a limited number of years in return for a disclosure of the process. Whatever may happen during the term of the monopoly, the patent system certainly fulfils the objective of disclosing the invention to the world so that it may be used by others after the expiration of the monopoly. Patent specifications constitute an important part of the technical literature and in many arts they constitute the main body of up-to-date information available to the public. Readers may recall a standard work on colour photography which was based to a large extent upon patent specifications.

This dissemination of information is conducted substantially at the patentee's expense (the United Kingdom Patent Office is nearly self-supporting from fees paid by patentees and applicants for patents). In this connection it is worth noting that for the expense of obtaining a patent in the United Kingdom or the United States the patentee obtains a monopoly only in the one country. There is no such thing as the often referred to 'world cover'. A patent must be obtained separately in each country in which a monopoly is desired. By the same token foreign inventors frequently apply for patents in the United Kingdom and the United States and so help to contribute at their expense to the technical information available. Clearly the outcome of these activities is beneficial to the public and, moreover, the value of the information in the patent specification should not be thought of as being confined to enabling the public to use the invention after the expiration of the monopoly. It is probably of more value as part of the sum total of technical information upon which further technical advance is based.

On the other hand it has always been intended that the patent should operate not only to make the invention available to others after the expiration of the monopoly, but also to encourage the introduction of the manufacture by the inventor with as little delay as possible. We must thus inquire whether the patent system tends to encourage or discourage the early introduction of new manufactures. Again confining the discussion at the moment to practices which are legitimate, we have to weigh two opposing tendencies. In the first place the patent is intended to encourage the investment of capital in a new development because of the protection which it affords, and it is thought that for the reasons outlined above the trend towards the creation of large numbers of relatively weak patents does not vitiate this intention. The patentee by and large gets an effective

measure of protection. Where, on the other hand, this development of the system is objectionable is in the extent to which it renders uncertain the freedom of any one manufacturer to embark on a new process without reference to other firms' patents. The effectiveness of the 'web' of patents, as we have called it, is partly dependent on the complexity of the interlocking rights which it sets up, and this enhances the confusion that has always existed owing to the inherent uncertainty of patent litigation. It is thought that where the trend towards complex patenting is most marked, one of two opposite results may sometimes ensue: either firms may avoid entering a field altogether, rather than disentangle what they are free to use from what is validly covered by another firm's patents; or a tacit understanding may arise among a substantial proportion of the firms engaged, especially in a newly developing field, that all patents relating to this field should be ignored. Either eventuality is contrary to the proper operation of the patent system.

The writer's own opinion is that, although the system is indeed open to the objection just discussed, it is the only one so far devised which reconciles two conflicting requirements of public policy: the encouragement of technological innovation by commercial interests, coupled with encouragement to make available to the public the maximum amount of information about such innovation.

It should moreover be noted that, so far as the United Kingdom is concerned, the objection that a multiplicity of patents of dubious strength renders third parties' freedom to use a particular process or to make a particular article uncertain, is mitigated by the requirement that the patentee is required to pay an annual fee of increasing value if his patent is to remain in force after its fourth year. This has the advantage that a certain amount of dead wood is constantly removed from the scene. There is no provision of this kind in the United States where no fee is required to maintain the patent in force for its full term.

(b) *By Transferring or Licensing the Monopoly*

The use of patents so far discussed is the building up of a defensive screen of relatively small patents behind which a manufacturer may be reasonably sure of a monopoly in the new manufacture at which he is aiming. The words 'new manufacture' are operative here. If the manufacturer is making a product which is overall conventional, for example, a motor car, he is not likely to have more protection than is afforded by a small number of patents for isolated improvements. He cannot look to a 'patent situation' to protect him overall.

But the use to which a patent can be put is not restricted to the sole

enjoyment of the monopoly by the patentee. Thus, he may assign the patent to another, or he may grant a licence to one or more others to use the invention the subject of the patent. Licensing is not in general a sharing of the patent monopoly, but the granting of permission to one or more others to, as it were, enter the forbidden territory. The monopoly or a part of it is only transferred if the patentee assigns the patent, or grants an exclusive licence, or covenants to restrict the number of licences which he will grant. For such consideration the assignee or licensee may be expected to pay a lump sum of money or an annual minimum royalty. On the other hand, a bare non-exclusive licence merely conveys a covenant on the part of the patentee to refrain from suing the licensee for infringement when he uses the invention, and for this bare right an appropriate payment is a royalty based on the extent of use of the invention, although if the patentee is prepared to guarantee this immunity for a substantial period, a fixed payment by the licensee may also be warranted.

Apart from these premium or royalty payments a variety of other benefits may be secured by the patentee in return for the licensee's immunity. Some of these are deemed to be in restraint of trade because they tend to extend the patentee's monopoly beyond that which he has been granted by his letters patent, and will be considered below under the heading 'Misuse of Letters Patent'. It is however admissible, for example, to use the patent to secure resale price maintenance, or the division of territory as between the patentee and one or more licensees.

Another important type of consideration for a licence is the agreement by the licensee to grant a 'cross-licence' to the patentee under one or more of the licensee's own patents.

The licensee for his part will usually try to obtain access to the patentee's information and 'know-how' in connection with the licensed invention. Where, as is often the case, the licensor is in possession of the information and know-how required to make the invention a commercial proposition, it may appear that this information and know-how is the more valuable part of the transaction. It may indeed happen that the parties use a patent of doubtful validity, as it were, as a peg on which to hang a know-how agreement. It should not be overlooked, however, that if there is a valid patent and if the patentee can be persuaded to grant an exclusive licence, or at least to restrict the number of licensees, the licence under the patent may well be of considerably more value than the technical information or know-how. It is a difficult matter to keep technical information secret and employees in possession of know-how may transfer their

allegiance. In any case the whole story may be given away by the manufactured product which is on sale to the public. The patent is the only instrument which can be used to prevent imitation of the invention, for once the technical information and know-how become public property their use cannot be prevented.

We have mentioned cross-licensing. This practice is well suited to the proliferation of patents described above. If one firm owning a package of patents can agree with another firm owning another package that each shall have the right to use the other's patents royalty-free, much labour which would otherwise be necessary in ascertaining which patents are involved in which manufacture, and so forth, is avoided. The practice may be extended from the bilateral to the multilateral plane. Multilateral cross-licensing arrangements are usually referred to as patent pools. Each of a number of firms engaged in the same art agree to pool their patents in such a way that each member of the pool is entitled to use any invention in the pool on payment of an appropriate fee which is shared between the members. The share which each member is entitled to may be assessed on the basis of the relative value of his inventions in relation to the aggregate of inventions in the pool, as determined by agreement with the parties or by some impartial 'pool manager'. Patent pooling arrangements are likely to be of value when research or development is being carried out by a consortium of firms. For example, it has recently become known that there is to be a consortium of aircraft manufacturers to develop a jet-propelled airliner. It appears that the only satisfactory way of dealing with inventions which may arise during such development is to pool them between the members of the consortium.

Pooling arrangements in the United Kingdom are perfectly legitimate provided they do not embody restrictions of the kind deemed to be against the public interest under the Restrictive Trade Practices Act. It is thought that an arrangement of the kind outlined above would not involve any such restriction. Moreover, it would appear that pooling arrangements will no longer be within the ambit of the Monopolies Commission as re-constituted by the Restrictive Trade Practices Act, because the pool is essentially an arrangement between autonomous firms, whereas the Monopolies Commission is now concerned with the monopolistic activities of single firms or groups. The situation in the United States is quite different. In the first place the need for pools is likely to be felt to a less extent in the United States than in the United Kingdom because the research organizations of the more important firms tend individually to be large enough to cope with the scale of research required

for contemporary developments. Secondly, pooling arrangements which would be legitimate in this country may very well contravene the anti-trust law in the United States. This question is dealt with more fully below.

(c) *Patents Owned by the Government or Public Bodies*

This discussion would not be complete without a reference to publicly owned patents. Both the United Kingdom and the United States Governments apply for patents on a considerable scale and in the United Kingdom there is a number of public corporations, nationalized bodies and the like which own patents, sometimes on a substantial scale. In the United Kingdom it used to be the tradition that a civil servant could enjoy the fruits of any commercial exploitation of inventions made by him in the course of his employment. With the increase of Government research this policy began to become unworkable, but the Crown was nevertheless reluctant to rob the civil servant of the right he had always enjoyed, without putting something in its place. Moreover, it was felt that a number of inventions made in Government research establishments might stand a better chance of being introduced into industry if a body were set up having this as one of its functions.

Such a body, the National Research Development Corporation, was accordingly set up by Parliament,[7] and one function of the Corporation is to endeavour to interest industry in inventions arising from Government research. The Legislature has provided that this activity should be self-supporting and the Corporation accordingly charges royalties at commercial rates for the use of inventions which it succeeds in introducing to industry. An *ex gratia* award may be made by the Government Department concerned to the Crown Servant who made the invention, and this is paid by the Corporation from the royalties so acquired. Similar considerations may apply to other public bodies; for example, it appears that a similar policy is adopted by the United Kingdom Atomic Energy Authority. In addition to patenting as a device to secure commercial exploitation, the Government may engage in patenting of the 'defensive' kind referred to above, i.e. to maintain its own freedom in the face of possible third parties' patents. It should be noted that the patent monopoly, *qua* monopoly, is not of direct value to a nationalized or publicly owned body because such a body is not concerned to prevent competitors from using its inventions. The patent monopoly may, however, be turned to good account in various ways in furthering the policy of the public body which owns it. For example, the body may

[7] Development of Inventions Acts 1948 and 1954.

make use of it to encourage its development contractors by granting them exclusive rights. Again, the public body or its contractors may be interested in securing rights overseas, in which case it is convenient to file a patent application first in this country and use it as a basis for claiming priority under the International Convention[1] for patent applications overseas.

It is thought that so far as the United States Government is concerned the primary consideration is the 'defensive' one. It has been mentioned above that defensive patenting is more important in the United States for technical reasons than it is in the United Kingdom. Moreover, it is the policy of the United States Government to grant non-exclusive royalty-free licences under its patents to all comers, and so long as this policy prevails the patent as a monopoly is of no value. In view of the divergence of the policy of the United Kingdom and United States Governments in this respect, it is interesting to note the reasons for the United States Government's policy. The main reasons appear to be firstly that the United States Government does not want to put itself in the position of selecting an exclusive or a restricted number of licensees, and secondly that it is not fair to charge one or more individual members of the public royalties on inventions produced at the public expense. Spokesmen for the United States Government have said that it is concerned only to secure maximum utilization of its inventions by industry and have contended that this can best be done by its policy of royalty-free licences to all comers. Experience in the United Kingdom contradicts this contention. It is of course true that some inventions sell themselves to industry, but on the other hand many do not, and it is thought to be legitimate to make some effort to sell promising inventions to industry and to charge at least enough of a royalty to make this enterprise self-supporting. The difference between the points of view of the United States and the United Kingdom Governments may be partly due to a greater readiness by United States industry to interest itself in new developments.

III. THE POSSIBLE MISUSES OF A PATENT

(a) *General*

The grant of a monopoly by letters patent has always been limited by the proviso that it shall not, to use the words of the Statute of Monopolies, be 'mischievous to the State . . . or [to the] hurt of trade or generally inconvenient'. This section is concerned with ways in which the patent monopoly may be mischievous, in restraint of trade,

[1] International Convention for the Protection of Industrial Property, Cmd. 5833.

or generally inconvenient, or indeed may fail in its primary object of encouraging new manufacture; and with the provisions of the current law for preventing these misuses.

No doubt in the days of the Statute of Monopolies a person would not go to the major trouble and expense which petitioning the Crown for letters patent must at that time have involved if he did not firmly intend to carry out the new manufacture. The position is quite different today. It has been shown in the preceding section that there is a wide tendency to apply for letters patent for any and every invention without there being necessarily any present intention by the inventor or his employer to use the invention. It will be clear from what has been said that this policy has nothing to do with the deliberate suppression of inventions, but on the other hand it does raise in concrete form the question of failure to use patented inventions. The possibility of deliberate suppression of inventions is dealt with below.

In order to guard against failure to work patented inventions the Patents Act provides certain remedies against so-called 'abuse of monopoly' by a patentee. The abuse of monopoly may be a failure to work the invention to an adequate extent in the United Kingdom, either by failing to satisfy the potential market for it or by satisfying the market by importation instead of manufacture in the United Kingdom. The monopoly may also be abused by a failure to grant licences on reasonable terms, with the result that export of the product of the invention or the working of an improvement invention the subject of somebody else's patent is prejudiced, or somebody else's trade in goods not covered by the patent is restricted. If anyone's interests are prejudiced by any of the abuses mentioned, he may apply to the Comptroller-General of Patents for a compulsory licence, but only if the patentee has had three years from the granting of his patent in which to start working the invention. If the Comptroller is satisfied that there is an abuse and that it could be remedied by the grant of a compulsory licence, he will order the grant of such a licence to the applicant or other appropriate person. If, however, after a further period of two years the abuse has not in fact been remedied, any interested person may again apply to the Comptroller who then has power, if all else fails, to revoke the patent.

The Patents Act is also concerned with conditions in patent licences which are of a type deemed to be in restraint of trade. Broadly speaking these conditions are of the kind which restrict other people's trade in goods not covered by the patent which is being licensed. This kind of condition is sometimes referred to as an extension of the monopoly properly granted by the patent. The kind

of thing which is envisaged here is a condition which compels the licensee to buy certain goods only from the patentee, for example, raw materials which are unpatented themselves, but which are used in carrying out the patented process. According to the Patents Act any such term of a licence agreement is void,[9] but what is more important is that the existence of such a term provides a defence against any action which may be brought by the patentee against *any* party for infringement of the patent. In other words, the existence of the void condition effectively renders it impossible to enforce the patent against an infringer if (and it is a big if) he is aware of the existence of the void condition in a licence granted to a third party.

A practice which is calculated to evade the provisions just discussed is sometimes made use of in connection with patents for processes using unpatented raw materials, for example, chemicals. The patentee may refrain from granting licences, but may let it be generally known in the trade that persons wishing to use the patented process may do so without a licence provided they buy their raw materials from the patentee. This practice is vulnerable to an application for a compulsory licence under the provisions relating to the abuse of monopoly[10] and the Comptroller may, in such a case, grant compulsory licences to the patentee's customers or his competitors in the supply of the unpatented materials. In practice this provision does not seem to provide an effective deterrent, because unless the patentee is charging an exorbitant price for the raw material it will generally not be worth while applying for a compulsory licence. This is particularly so where the patentee is already in a fair way to monopolising supplies in the raw materials by other means, and is using the practice under discussion simply to consolidate his monopoly. In such a case it is unlikely that a competing supplier of the raw material would be sufficiently interested to wish to take action to have a compulsory licence granted to his customer, and the latter, for his part, would probably not feel that an application for a compulsory licence would open up any useful alternative source of supply. This at all events has been so in cases known to the writer. It is of interest, however, to note that in the circumstances just outlined a theoretical remedy would be a reference by the Board of Trade to the Monopolies Commission, followed by an application by a Government Department to the Comptroller for a compulsory licence to remedy any malpractice condemned by the Commission. In most practical

[9] Except that the condition is not void if the licensor can show that the licensee had an option for a licence on reasonable terms not containing the void term, and is entitled to relieve himself of liability to observe the term on certain conditions which are laid down in the Act (Patents Act 1949, Section 57).

[10] Patents Act 1949, Section 37 (2) (e).

cases such a procedure would be rather too much like using a steam hammer to crack a nut.

To sum up, the weapons in the armoury of the public to prevent misuse of the patent monopoly are by no means negligible. They comprise compulsory licensing and, in the last resort, revocation of the patent on the one hand, and the voiding of restrictive licensing terms coupled with a sanction which may render the patent nugatory against third parties on the other.

The jurisprudence of this aspect of patents is regarded quite differently in the United States, although curiously enough the net result may not be very different in practice. In the United States there are no restrictions on the monopoly of the patentee as such. In this respect the United States differs from most other countries, where provisions similar to those of the British statute apply. On the other hand, the United States has a severe and comprehensive system of law against trusts. It has long been held that the patent legislation and the anti-trust laws are not mutually exclusive but complementary, so that if a patent is used in such a way as to violate an anti-trust law, such use is subject to the normal sanctions and penalties of that law. By and large this means that a patentee is not likely to be vulnerable in respect of anything which he does by himself, i.e. without agreement with other independent parties, with an individual patent. The writer is not aware of any provision of United States law which would prevent a patentee from suppressing his patented invention entirely. On the other hand, it is all too easy for a United States patentee to infringe anti-trust legislation by the ways in which he may license the use of his invention. Broadly speaking any licensing practice which would be void under the United Kingdom Patents Act would contravene the United States anti-trust laws, but there is the important difference that while the sanctions in the United Kingdom are solely patent sanctions, those in the United States are the penalties appropriate to any contravention of the anti-trust legislation. For example, the practice of refraining from suing infringers of a patented process who use raw materials supplied by the patentee would clearly be contrary to the Clayton Act and would carry appropriate penalties.

But, in addition to covering most of the practices which are illegitimate in the United Kingdom, the United States anti-trust laws go further in certain respects. The first is resale price maintenance. The position in both countries is that the sale of a patented article by the patentee or his licensee in general confers on the purchaser freedom both to use the article and resell it. This implied licence may, however, have conditions attached to it provided the

purchaser has appropriate notice of such conditions. If the purchaser fails to observe the conditions he may be sued by the patentee for infringement of the patent (not for breach of a licence agreement — the significance of this distinction is brought out below). One of the conditions which may be and commonly is imposed on the purchaser of a patented article, is that he shall not resell it at a price below a fixed minimum. The use of a patent in this way to enforce resale price maintenance violates the United States anti-trust laws, but it is perfectly legitimate in this country.

Another practice which is illegal under the United States anti-trust laws is the exclusion of a licensee from certain territories, unless such restriction flows from the existence of a valid patent. This illustrates an important general point, which is that some restrictions, such as the one just mentioned, are legal in the United States if they flow from valid patent rights, but illegal if they do not. Another example of such a restriction is the agreement with a licensee that he will not sell goods made under his licence below a minimum price (this should be distinguished from resale price maintenance imposed upon a purchaser having no contractual relationship with the patentee). A patentee who imposes such a restriction on a licensee may find that if the Courts hold his patent to be invalid he has been offending under the anti-trust laws. This leads to the anomaly that the patentee cannot know if he has done wrong or not without having recourse to the Courts, for no one except the Courts can determine whether the patent is valid. Another anomaly arises in the following situation: it is legal to agree with a licensee under a United States patent that he will not sell the patented goods in other countries where the goods are covered by patents. On the other hand, it is illegal for the licensee to agree not to sell in countries where the goods are not covered by a patent. The question arises whether the United States Courts would take notice of the validity of the foreign patents in question. If so, by what process of law would they determine whether a patent in a foreign country was valid according to the laws of that country? For those interested in these finer points of jurisprudence it should be noted that a somewhat comparable distinction lies in the United Kingdom between restrictions or conditions which flow directly from the patent and are enforceable by an infringement action, for example, conditions imposed by notice on a purchaser of the patented goods; and restrictions imposed by contract, i.e. by a licence agreement. It is only the latter which could fall foul of the provisions in the Patents Act rendering certain restrictive conditions of licences void.

There is another matter of the utmost importance in respect of

which the United States anti-trust laws are more severe in their operation against patentees than the United Kingdom provisions against abuse of monopoly, namely, arrangements involving the creation of common interests between autonomous patentees, for example, by cross-licensing and the pooling of patents. The position in the United Kingdom in relation to such arrangements has been discussed above. In the United States it is likely that cross-licensing and pooling agreements will contravene anti-trust laws unless they are open on equal terms to all comers. Again, as is well known, the United States Department of Justice may decide to file an anti-trust suit against an individual United States firm and in such cases the patents owned by the firm will invariably constitute one of the elements to be taken into account. Two recent examples of judgments in anti-trust suits which had far-reaching effects on the patent property of the firms in question, were the consent judgments in the suits against American Telephone and Telegraphy Company and the International Business Machines Corporation. These suits were both concerned with the alleged monopolization of business by the respective firms. For example, I.B.M. was accused of monopolizing the tabulating industry in the United States to the extent that 90 per cent of all tabulating machines in use were owned by I.B.M. The wider aspects of this alleged monopolization are outside the scope of this article, but of immediate relevance is the fact that in both cases the judgments were largely concerned with the use of patents by the respective firms for the furtherance of their policies. So far as this aspect is concerned, the essence of the judgment in each case was the compulsory licensing of the entire patent holding of each firm, apparently to all comers. In some cases the licences were to be royalty-free and in others they were to be at a 'reasonable royalty'. For example, in the case of the A.T. & T. suit some 8600 existing patents of A.T. & T.[11] and its associated company — Western Electric Co. Inc. — which was also joined in the suit, were to be licensed royalty-free. It appears that the basis for this penal provision was that these patents were the subject of cross-licensing arrangements with General Electric Company, Radio Corporation of America and Westinghouse; although the release by the Department of Justice on the subject does not say so, it may perhaps be inferred that these cross-licensing arrangements were royalty-free. Perhaps even more significant is that the judgments relate not only to existing patents, but to patents which may be obtained in the future. In the case of I.B.M. this

[11] It is interesting to note the numerical extent of A.T. & T.'s holding of patents as revealed in the consent judgment. It confirms the writer's views about the proliferation of patents discussed above.

applies apparently only to patents obtained over a period of 5 years, but in the case of A.T. & T. there appears to be no time limit. This is expropriation with a vengeance.[11]

Before leaving this general question of compulsory licensing reference should be made to a practice which is peculiar to the United Kindom law and is of considerable importance in a particular field, namely that of medical inventions. The Comptroller is obliged to grant a compulsory licence under any patent relating to food or medicine to anyone who applies for such a licence 'unless it appears to him that there are good reasons for refusing the application.'[12] The view is generally held that the Comptroller will feel obliged to grant a compulsory licence under this Section to any reputable firm applying for one. This provision of our law appears to be rooted in sentiment rather than in logic. There is no branch of industry in which a new product requires a more exacting and expensive programme of research and development than the pharmaceutical industry. Moreover, it is frequently all too easy for a pirating firm to benefit by the research of a competitor, because it is traditional in this field for all the relevant results to be published. If patents are granted to encourage new manufactures in other industries it is difficult to see why the same considerations should not apply to the pharmaceutical industry. It is admitted that an abuse of a patent monopoly in the pharmaceutical field would be likely to be particularly objectionable, but the reader will have appreciated that there is ample scope in the general provisions regarding abuse of monoply to prevent abuse, and there is no doubt that if any case were brought under these provisions in relation to a pharmaceutical invention, the Comptroller would be particularly careful to see that the abuse was remedied. There is nothing in the United States law corresponding with this provision of our law. The writer has heard it said that it is impossible to promote a new pharmaceutical product in the United States unless the promoter is reasonably sure of a monopoly at least during the promotional period[14] and he is aware of no case in which such a monopoly has been used to withhold a proven product from the public.

(b) *Can Patents be Used to Suppress Inventions?*

This is one aspect of the possible misuse of patents which fre-

[11] But still the mergers go on. A matter of 50 Bills are at present before Congress for strengthening the anti-trust laws.

[12] Patents Act 1949, Section 41.

[14] It should be noted that an application for a compulsory licence under Section 41 can be made at any time after the grant of the patent; the period of three years after grant in the case of compulsory licences for abuse of monopoly does not apply to licences under patents for food and medicine.

quently exercises the public — so much so that one might almost say that it has entered into the realms of folklore. We are referring here to the deliberate use of a patent to prevent the introduction of a new process or product by manufacture in the United Kingdom or, for that matter, by importation. From time to time letters appear in the press bemoaning the fact that patents are or may be used in this way, and a hardy annual in such correspondence is 'the everlasting match' which one is supposed to be able to light 50 or so times before it is discarded. Two patents alleged to cover one such device lapsed in 1936, so that the manufacture of at least one everlasting match has been free for all since then.[15]

If the reader has followed the argument in the preceding pages he will have realized that a patent is wholly unsuited to the purpose of suppressing an invention. Even important developments (and it is only important developments which would be worth suppressing) at the present time are usually the sum of a host of quite small steps made by a number of individual workers or teams. While the 'web' of patents which the manufacturer may secure in respect of these improvements may be effective as a first line of defence against any would-be imitator, in a situation where the manufacturer is trying to suppress an important development which the public wants it is extremely unlikely that a determined competitor would not be able to evade any valid parts of the aggregate of patents by a determined effort to 'design round' the relevant patent claims. Moreover, even if this is not possible and the competitor has to use a key improvement which falls squarely within an apparently valid claim of the patentee, the latter can have no certainty, except in the rarest case, that he could successfully sue the infringer. It is true that exceptionally an important 'master patent' emerges. Perhaps a good example of this is the patent which Sir Frank Whittle[16] obtained several years before the war for a gas turbine-jet engine. This sort of patent stands out as one in a score of years, but even then there is likely to be an inherent difficulty in using the patent to suppress the development and use of the invention. We are hypotheticating the case in which the inventor covers the broad idea of his new development right at the start, rather than piecemeal by a series of patents on the steps taken during the

[15] A full discussion of the patent position with reference to the everlasting match is given in chapter 7 of the *Report on the Supply and Export of Matches and the Supply of Match-Making Machinery* by the Monopolies and Restrictive Practices Commission.

[16] U.K. Patent Specification No. 347206 (1930). The broader claims are of general interest in the context of this paper and Claim 3 is quoted below:

'A propulsion device in which a centrifugal turbo-compressor supplies compressed air to a heating chamber whence the air passes to drive a turbine which mechanically drives the compressor, and whence in turn the air and products of combustion escape to the atmosphere through passages which cause them to produce propulsive thrust.'

development of the idea and its reduction to practice. In other words, the invention at that stage is pretty much a paper idea (this is believed to have been the case with the Whittle patent for example). Now, in order that the patent may be valid not only must the invention be useful in the sense that it does what the inventor promises in his specification that it will do, but also the complete specification must disclose the best method known to the inventor of carrying out the invention. If the patentee's subsequent experience shows that he made the right guesses in his specification he may be able to sustain an attack against his patent, but he will not have had any such experience unless he has developed the invention and brought it into practice. Once again, therefore, it would be unrealistic to expect such a patent, even though it is a 'master', to serve as an instrument for suppressing the invention.

But suppose in an exceptional case the patentee did find himself in a position in which he could use his patent to suppress the invention. It will have been made abundantly clear in the part of this article dealing with abuse of monopoly that any member of the public who was aggrieved by the failure of the patentee to work the invention could apply for a compulsory licence. Moreover, if he could make out his case he, or some other appropriate person, would almost certainly be granted such a licence. There is of course the difficulty of getting to know enough of the picture to make out a case to satisfy the Comptroller. In the sort of situation we are considering here, however, this should not present too great an obstacle. The existence of the patented invention is known to the public at large because the patent specification is published. A stark failure by the patentee to take any steps towards working the invention should surely be easy enough to prove. The proceedings, like others before the Comptroller-General of Patents, are not expensive. The interesting thing is that resort has so seldom been made to these provisions of the Patents Act which have been part of the law for 50 years. It is thought that the number of cases which have been heard in all that time could be counted on the fingers of two hands and that none of these cases was concerned with an outright failure to introduce the patented invention.[17] An open invitation to the public was made by the Swann Committee which sat just after the war,[18] to bring forward evidence of the suppression of inventions by patents, but not a

[17] It should not be thought that the paucity of cases means that these provisions of the Patents Act are unimportant. They act as a reserve power which has its effect in shaping the policy of patentees, particularly where the patentee is a foreigner who wishes to exploit his invention in the United Kingdom by importation only.

[18] Patents and Designs Act, Second Interim Report of the Departmental Committee, Cmd. 7689.

solitary piece of evidence was submitted. Moreover it could be expected that if any such situation had arisen since the National Research Development Corporation[19] had been formed, the activities of that body would have brought it to light.

Another interesting fact is that in the United States, as stated above, there is no provision in the patents legislation for compelling a patentee to use his invention or allow others to use it. If patents were apt instruments for the suppression of inventions one would therefore expect more suppression in the United States than in this country. While there is no direct evidence on the point, the writer believes that this is not the case.

To sum up, patents are on the whole better adapted to foster development than to suppress it; they provide a defensive screen which is most likely to hold out if the patentee is using the inventions covered by the patents, but is otherwise likely to cave in under the pressure of competition.

It is true that many important technical developments never come into use. A detailed consideration of the reasons for this would be outside the scope of the present article, but it is relevant to point out briefly the salient factors. To the member of the general public (the person, for example, who complains that 'the everlasting match' is not brought into use) it seems that some developments should quite obviously be taken up, but the point is that he sees only a small part of the picture. Ultimately the determining factor must be the estimated profitability of the new capital expenditure involved in the case of private enterprise, or the estimated economic value in the case of public enterprise. The consuming public may express surprise that this or that development is not taken up, but the question is 'How much would they be prepared to pay for it in hard cash?' This is the long-term factor. In the short-term the opposing factors of competition and inertia may be decisive. In the United States, for example, competition is keen and inertia small and it is very unlikely that some manufacturer will not be found willing to take up a new development which has any chance of being profitable. In the United Kingdom the tendency is the other way; in many industries competition is far from keen and resistance to the introduction of new developments high. Where the competition in an industry is not sufficient to overcome what may be called the 'threshold of inertia' against the introduction of a new development, it may be possible to overcome this threshold by a 'pump-priming' operation. One of the functions of the National Research Development Corporation is the provision of funds to enable inventions which cannot overcome this

[19] P. 168 supra.

'threshold', but which are nevertheless thought to be worth while in the long-term, to be developed to the point at which they are attractive for one or more manufacturers to take up.

CONCLUSION

The patent system has developed over the centuries from the Statute of Monopolies on the following lines: Starting with the grant of a monopoly to the introducer of a whole new manufacture, the monopoly came to be granted for the introduction of an improvement in a manufacture. Throughout the nineteenth century many such improvements were of an isolated and important character in relation to the art concerned and the patent system was excellently adapted to protect improvements of this character. Over the last 50 years technological development has enormously intensified and improvements arise with great frequency, but each is likely to be relatively small. Correspondingly, firms which engage in intensive research and development acquire vast numbers of patents each of small significance in itself. It has been shown how a 'web' of patents may thus be built up to protect any particular new line of production and how it may provide effective protection. This does not vitiate the broad purposes of the patent system, namely the encouragement of new manufactures and the publication of information about them, except to the extent that the proliferation of patents in difficult technical fields may lead to some confusion as to what rights the patentee may legitimately exercise, and thus upset in either direction the balance between the established innovator and the would-be new entrant in particular fields of manufacture.

The development of the patent system has not of itself increased abuses of patent monopoly of the kind against which the United Kingdom Legislature has provided. The United States looks at the matter differently: there is no provision in the patent law against abuse of monopoly, but ample sanctions are provided by the anti-trust laws, and the proliferation of patents by a single firm (without any 'abuse' in the British sense) is likely to attract the attention of the authorities as a predisposing factor towards infringement of anti-trust laws. At all events both countries, in their different ways, have powerful safeguards against the misuse of patents and, at any rate so far as the United Kingdom is concerned, the safeguards have but seldom been invoked. In particular the safeguards are thought to be effective to prevent the use of patents to suppress inventions even if, as is believed however not to be the case, patents were suitable instruments for this purpose.

LONDON

CRUDE OIL PRICES IN THE UNITED STATES AT THE GULF COAST[1]

by WAYNE A. LEEMAN

ECONOMISTS observing the institutional structure of the oil industry and noting the remarkable stability of crude oil prices during the last couple of decades have held generally that these prices are *administered* or *controlled* prices rather than prices reflecting the action of a fully competitive market. Statements to the contrary, however, are frequently made by members of state regulatory bodies and spokesmen for the oil industry. It is the purpose of this paper to explore, more fully than has been done up to now, both the elements of control and the forces of competition which are to be found in the price of crude oil in the United States at the Gulf Coast.

One cannot with accuracy treat the entire country as a single market for crude oil. The West Coast region, comprising the states of Washington, Oregon, California, Nevada and Arizona, has generally been considered quite a distinct market, the remote oil of the Rocky Mountain area has its own fairly distinct price structure, while the oil industry in the Middle West, with its great diversity of sources of supply, also to some extent stands by itself. We will, therefore, confine our analysis to the price of crude oil at the Gulf Coast. In analyzing this price we may justly claim to be analyzing the most basic oil price in the United States and one of the two most fundamental oil prices in the world (the other important world oil price being the price of Middle East crude). The prices of the Eastern Seaboard, Middle West, Rocky Mountain and even California crudes are to a greater or lesser degree tied to the price known as 'U.S. Gulf', and many people in the oil industry believe that the price of crude oil in the Middle East still is connected closely to this same price.

Those who think that crude oil prices are administered prices generally believe that much, though not all, of the control is to be found on the supply side of the market, and it is here where we will begin our analysis.

We shall see that the picture is close to that of oligopoly, competition among the few, but oligopoly modified so considerably by the possibilities of entry as to provide what appears to be quite an

[1] The author would like to thank all of the many people connected with the oil industry and in government who were so patient in answering his questions during the course of this study.

ample degree of competition. The oligopolists are the three principal producing states east of the Rockies, Texas, Louisiana and Oklahoma, each of which in effect acts as a unit in producing its oil, plus the five 'international majors' which import oil into the United States or sell it to others for import, Standard Oil Company of New Jersey, Socony-Mobil Oil Company, Gulf Oil Corporation, The Texas Company and Standard Oil Company of California.

Let us consider first the situation in the three important oil-producing states.

I. CONTROL BY STATE CONSERVATION AGENCIES

Each month the state regulatory bodies, in part at least in the interest of conservation, set the total production for their respective states and prorate that production among the various producing wells. Marginal or 'stripper' wells are exempt from limitation in output which means that production quotas for the remaining wells are smaller than they otherwise would be. In each state total production is definitely limited.

Few acquainted with the subject would deny that some state restrictions on production are needed. Experience shows that under the common law 'rule of capture' the several owners and leaseholders of wells drilled into the same field will, in the absence of restrictions, compete with one another to get the maximum production out of their own wells in order to prevent oil from migrating towards rival outlets. Such competitive extraction reduces underground pressure so rapidly that much of the oil is never recovered. Petroleum engineers have worked out the concept of a Maximum Efficient Rate of production (MER), defined as that rate of extraction which will result in maximum total recovery of oil from under the ground. In applying this definition, they make, of course, explicit or implicit assumptions that particular techniques will be used in extracting the petroleum; engineers who estimate MER probably would state that they assume techniques which involve 'reasonable' costs. Actually of course these engineers may make good or poor judgments as to present and future needs for petroleum products when they decide what costs might reasonably be incurred in producing oil. To the extent that their judgments are good, the state agencies which restrict production to something approximating MER are doing all that government need do to promote an optimum time distribution in the rate of use of oil.[2]

[2] Some economists might feel that state authorities should permit extraction at a rate in excess of MER, discounting the value of oil in the future. (Engineers have considered the future, and presumably discounted it, only in selecting the techniques which they believe involve reasonable costs; the present must still be balanced against the future in

In the states we are considering conservation is interpreted more broadly than limitation of production to MER. Efforts are made to limit production to an estimate of market demand for, it is argued, if production is in excess of demand, undue oil will be stored above ground leading to physical waste through evaporation, fires and leakage. Moreover it is contended that production in excess of market demand will result in price instability, presumably involving very low prices immediately after a large discovery and a consequent uneconomic use of petroleum, say for oiling roads. So the state agencies try to find out market demand through figures supplied by the Department of Interior and through monthly 'nominations' provided by the major purchasing companies and they seek to regulate production accordingly.

However, this 'market demand proration' by state regulatory bodies is rather difficult to justify. For beyond state restriction to check competitive extraction from common pools, the self interest of private parties concerned can be relied upon to prevent waste. The owners of the oil will be aware of the losses caused by evaporation, fire and leakage and will not extract and store above ground more oil than is needed to fill the pipelines, supply the refineries and generally serve the consumer. Moreover, there is little reason to believe that periodic new discoveries would, in the absence of state limitation of production to market demand, result in great instability of price. It is true that a great new discovery might lower the price of oil if men concluded that oil supplies in the foreseeable future were going to be more abundant as a consequence, but such a price reduction would be entirely in keeping with the needs of the economy as a whole. Smaller discoveries probably would not cause a marked, temporary decline in price, such as to cause a wasteful use of petroleum products, because either the discoverers or others would see future more important needs for the products of oil and would hold the oil off the market, underground, so as to realize a better price at a later date.

The actions of state regulatory bodies, then, can be defended when they limit production approximately to MER, since otherwise, given the rule of capture, individual self interest would result in a wastefully rapid extraction of oil. But the actions of state agencies are much less defensible when they go beyond this and limit production to market demand inasmuch as the self interest of oil men themselves will, once competitive extraction from pools held in common is eliminated,

deciding the most economic rate of production.) While the impatience of men might justify production greater than MER, a good case can also be made for producing at less than MER in order to maintain reserve productive capacity for national defense. Hence my cautious statement that authorities interested in conservation might seek some approximation to MER.

ensure that oil is not produced in such quantities as to result in wasteful storage above ground or temporary and unwarranted price declines with a resultant wasteful use of oil.

During the periodic controversies over the actions and policies of state conservation agencies, there has been much debate as to whether state regulatory bodies set prices by their control over production. The state agencies deny that they do so and they often have the support of the oil companies in their denial, while many, if not most, economists outside the industry have held that regulation of production by the states does control price. Let us examine the two positions.

Outside economists sometimes assert that the market demand to which the state agencies limit production is demand *at a price*; presumably different amounts would be demanded at higher or lower prices. Men in the regulatory agencies reply that the demand for petroleum products is inelastic and that moderate changes in price would not alter the amounts demanded. This is probably true, but is actually conceding a great deal, for if demand is in fact inelastic, then even small adjustments in supply have marked effect on price. That the actions of the state regulatory bodies influence price, therefore, seems very nearly beyond argument.

In fact men in the state agencies and others might well admit this influence; it is in the nature of an effective conservation program to reduce supply below what it otherwise would have been and as a consequence usually to maintain the price at a higher level. As a matter of fact the higher price serves a most important function in conservation; it rations out the scarcer supply and prevents the utilization of a valuable commodity in less important uses. For example, restrictions on the production of crude oil raise the price and make it too expensive to be used extensively in oiling roads. (A good example from another industry of the influence on price which conservation activities may have can be found in the wheat market. Speculators anticipating a future need buy up and hold wheat; the price is maintained or increased and grain needed for later human consumption will not be fed to animals.)

It is the opinion of the writer that state conservation agencies and spokesmen for the oil industry would do well to admit that conservation activities influence price. Indeed they might even boast about it.

Up to this point the reader may be inclined to conclude that the price of crude oil is definitely a controlled or administered one and, moreover, inclined to suspect that the states limit production more than is desirable. But this conclusion is by no means quite certainly correct. For there are factors which definitely limit the powers of the

state agencies in controlling production and price. There are (1) competition among the oligopolists and (2) the possibilities of entry into crude oil production.

II. OLIGOPOLY LIMITED BY RIVALRY AND ENTRY

The most obvious limitation on the actions of the state regulatory bodies is the competition of rival producing states as well as the competition provided by importers. Any one of the principal producing states — Texas, Louisiana or Oklahoma — might want to restrict production of crude oil in order to maintain or to increase price, but it will hesitate to do so if it doubts that the other states will do likewise or it doubts that the international oil majors will restrain imports. No one state wants to cut back production only to see another state or an importing firm fill the gap by expansion of its output. Each of these three states watches the others narrowly and frequent accusations are made by one or the other that a neighbor is failing to do its share in restricting production. Moreover each state carefully watches the volume of imports and often the state agencies register vigorous complaints on this score.

We have here, therefore, a market very close to that of oligopoly. Although the states are not concerned directly with price, do not themselves set actual prices, and officially will admit to no interest in this matter, they are very much interested in an important price-determining factor, namely the level of production, and when they watch each other closely in this respect, they are acting very much as oligopolists generally behave. The interests of the other members of the oligopoly, the major importing firms, focuses more directly on price, since they themselves set prices. Each of them maintains a close check both on the prices posted by the others and on the discounts from posted prices which are offered. During the summer of 1956 there was a good deal of anxious deliberation among those in and around the oil industry as to whether a price rise in the United States would be followed by a price rise in the Middle East, and of course such concern about the actions of rivals is very characteristic of oligopoly. Indeed upon query by the writer one of the members of the Texas Railroad Commission, the body which regulates the production of oil in Texas, was willing immediately to offer an opinion as to whether an increase in price in the United States would be followed by a similar rise in the Middle East. One is led to wonder if his expressed doubt that a U.S. price increase would be followed, had not caused him to hesitate in ordering a cut back in Texas production by which he otherwise might have hoped to get the price increase so much desired by Texas producers.

It is true that the competition provided the states by the major importing firms is limited by their hesitancy in increasing imports of foreign oil, imports which they fear might provoke an increase in tariffs or an imposition of quotas. But it is doubtful that importing firms are really checked very much by this concern. In fact the voluntary import restraint program administered by the Office of Defense Mobilization has not worked very well. When one firm in an important marketing area does not restrain its imports of low-cost foreign oil, all its competitors will be at a disadvantage if they do not likewise acquire some of this oil. Hence a single firm eager to steal a march upon its rivals is enough to break down a voluntary program. Moreover companies with new refineries in an area often insist that in order to be competitive they must have some foreign crude oil. So they import it while at the same time firms with older refineries refuse to cut back their imports in compensation for the new crude being brought in. The consequences of course are an increase in total imports. Crude oil imports have crept steadily upward since February 26th, 1955, when the President's Advisory Committee on Energy Supplies and Resources Policy recommended that imports should not exceed the proportions that these imports had to the production of domestic crude oil in 1954. Imports of crude oil during 1954 averaged 11.25 per cent of domestic crude production while by the third quarter of 1956 (before the Suez crisis) they had reached 13.8 per cent of a much increased domestic output. We may conclude that the oligopoly we are examining is an oligopoly of the principal producing states and the major importers each of which has a considerable possibility of increasing volume and each of which watches closely for opportunities to do so.

Of course it is possible that the principal producing states and the major importing firms would *agree*, implicitly or explicitly, to restrict production in order to raise price. As a matter of fact the various oil-producing states regularly get together in the meeting of the Interstate Oil Compact Commission to discuss matters of common interest and one can easily imagine the possibilities of oligopolistic collusion here presented. But in all sectors of the economy where oligopoly exists such implicit or explicit agreements are hard to obtain and harder to maintain and in the sector of the economy we are considering in this paper an almost complete freedom of entry and expansion makes it extraordinarily difficult for the state bodies and importing companies to agree on a restriction of output even with the opportunities afforded for discussion in the Interstate Oil Compact Commission. Indeed we have here the second of the two factors which limits the amount of control which the state conservation

agencies can be said to have over crude oil prices. Not only are the state authorities limited by the competition of the other producing states and the importers but they are limited by virtue of the fact that there are no serious restrictions on entry into oil production. Provided that crude oil prices are attractive men continue to drill both discovery wells and development wells and having drilled them they insist that they be given a production quota. Under such circumstances the state agencies find it extremely difficult to limit production in order to maintain or increase prices.

To be sure there is a difference between this oligopoly (of the principal producing states and the importers) and the more usual type of oligopoly, in that here entry occurs within the jurisdiction of some of the oligopolists, i.e. entry occurs within each of the states seeking to control production, while ordinarily in oligopolistic industries entry is from completely outside the administrative units of the oligopoly. But the consequences of the entry are the same in both cases, a check on the inclinations of oligopolists to limit output in the interest of higher prices.

Actually in the oil industry during the summer of 1956 it began to appear as though the principal producing states and the importers, like other oligopolists in other times, had been shortsighted and restrained production too much and had as a consequence of the higher prices obtained invited a great deal of additional capacity, perhaps even excess capacity, into the industry. For the drilling of exploratory and development wells had continued in past months at a very high level and state agencies found it necessary to give the wells which were brought in production quotas; as a result total production in the country plus imports was so great as to prevent a price rise which most industry spokesmen and many outside observers felt was warranted by the increased finding costs and production costs of crude oil.

In fact the situation during the summer of 1956 was almost exactly the opposite of what most outside economists who have looked into the matter have considered characteristic of the oil industry. Far from setting low maximum allowables in order to obtain or maintain high prices for crude oil, we find during this period the state conservation agencies setting, or attempting to set, *minimum* allowables. The Texas Railroad Commission has been setting allowables considerably in excess of what most purchasers consider appropriate, as evidenced by their 'nominations', and although buyers do not legally have to take the oil, most of the large ones make every effort to do so in order to avoid unpopularity in the oil-producing communities. And in Oklahoma we run into the ironical situation of a body, the

Corporation Commission, supposedly concerned in oil with conservation, attempting to force purchasers to take the full allowable whether they want it or not.[3]

Our conclusion must be that over the long run the state regulatory bodies have only limited control over price, that competition among the principal producing states and importing companies along with freedom of entry into oil production severely checks efforts to limit production and raise price.

So far we have considered only supply. It is now time to look at demand in order to determine the degree of competition and the extent of control to be found on this side of the market.

We may start out by observing that demand is of much less importance in the market for crude oil than is supply. Since World War II demand for the products of crude oil has grown steadily from 4 to 6 per cent a year in the United States and at a considerably higher rate abroad. Seasonal fluctuations occur — demand in winter is now greater than summer demand — but these are moderate in amount, are in large part handled by planned adjustments in inventories, and have a relatively small influence on product prices and almost no influence on the price of crude oil. Moreover, the market demand for petroleum products and crude oil is generally agreed to be inelastic, certainly far less elastic than supply, and this means, of course, that changes in demand are likely to have a much smaller influence on price than changes in supply. Finally, the demand for crude oil reflects the wants of millions of consumers and is embodied in the purchases of dozens of independent refineries; few if any buyers of crude have any substantial degree of control over the market. This, however, is a point which would be disputed by many and consideration of it immediately leads us to an examination of the position of the giant in the oil industry.

III. THE ROLE OF JERSEY STANDARD

To a very considerable extent the Standard Oil Company of New Jersey has inherited the mantle, and perhaps a little of the opprobrium, of Rockfeller's old Standard Oil Trust. The largest of the former members of the Trust and today the largest oil company in the world, it is believed by many, both inside and outside the industry, to exercise a decisive and controlling influence over oil prices. A good example of this belief is to be found in a recent statement made by the editors of *Business Week*. Speculating about the pos-

[3] Gulf Oil Corporation is going to court in an effort to establish its right to engage in 'purchaser pro-rationing', i.e. to establish its right to take less from each of the fields in which it is connected than the Commission sets as allowable. *Business Week*, July 21st, 1956, p. 128. *Petroleum Week*, September 21st, 1956, p. 12.

sibility of a crude oil price increase during the summer of 1956, they said: 'Without Jersey Standard's backing no increase would stick.'[4]

Actually it is very doubtful that Jersey has this kind of veto power over the prices which its rivals might seek to establish. It is more nearly correct to say that Jersey can set the price of crude oil only when its officials are right about the underlying forces of supply and demand. In truth of course these men are very often most accurate in their analysis of the market; even its closest competitors admit that Standard of Jersey is a very superior organization. But on occasions when Jersey Standard is wrong about underlying market conditions, prices will move without its support and even contrary to its wishes, and it will shortly have to fall into line. If supplies of crude are abundant, the rivals of Jersey will be able to buy their oil at low posted prices and Jersey will have to match these low postings for it cannot pay more for crude oil than its rivals and still be competitive in sales of product. If, on the contrary, supplies of crude are in short supply, the rivals of Jersey will post higher prices in order to maintain their connections in the oil fields at a time when some purchasers are offering premiums for crude oil; Jersey will have to go along with these higher prices in order to protect its own supplies. This latter situation was illustrated very nicely during the summer and fall of 1947.

In June of that year Mr. Eugene Holman, then President of Standard Oil Company (N.J.), in a speech initiated Jersey's now famous 'hold the line' policy on oil prices. Because at the time drilling was limited by a shortage of steel, Mr. Holman did not believe that a price increase would bring forth additional supplies. He said:

> In the present situation the unrelieved demand develops a strong urge to bid up prices in the competition for available supplies. We in Jersey Standard believe that under today's conditions, present crude oil prices in a majority of cases are adequate.
>
> It is difficult to see any benefit to the public — in either greater supplies or better products — from further increases in crude oil prices at this time.[5]

'Hold the line' was still the Jersey Standard policy in October but the conditions of the market would not sustain existing prices. On October 15th, 1947 Phillips Petroleum Company announced a 20¢ per barrel increase in the price it would pay for crude oil, defending

[4] May 12th, 1956, p. 98.
[5] *Journal of Commerce*, June 23rd, 1947.

its action on grounds that it was necessary to offset spreading premiums paid by rivals. Late that night Standard of Indiana and Deep Rock Oil Corporation announced that they would match the increase. The next day Jersey capitulated and its large subsidiary in the Southwest, Humble Oil, increased posted prices by 20¢ 'to protect badly needed supplies.' Then a few weeks later, on November 28th, Sun Oil Company raised its posted price for crude oil by another 50¢ a barrel, in order to meet premiums being offered by other buyers, and very shortly Jersey Standard along with other crude buyers had to meet the raise so as to avoid losing crude connections in the oil fields.[1] So Jersey failed to hold the line in 1947, and it seems safe to conclude that Jersey like the other majors can only set crude oil prices when they are right in their conclusions as to the underlying conditions of market supply and demand.

No oil firm can pay more for crude oil than its rivals and compete successfully in the petroleum products market and none can pay less and still maintain its connections in the oil fields. Hence among the dozens of crude buyers there is very little control over crude oil prices to be found and the demand side of the market cannot be looked to as a source of controlled or administered prices.

IV. PRICE INCREASES AT THE GULF FOLLOWING CLOSURE OF THE SUEZ CANAL

Early in January crude oil prices at the Gulf Coast increased about 45¢ per barrel. (Prices rose by a lower amount away from the Gulf so that the average increase in the United States was 35¢ a barrel.) Following a sharp rise in demand for U.S. crude, beginning in November (1956), and an interruption of imports from the Middle East, supply available at the Gulf Coast expanded rather slowly, though initially there were large inventories on hand upon which purchasers could draw. Inelasticity in supply of crude oil at the Gulf in part reflected purely physical limitations. Most of the excess productive capacity was in West Texas while direct pipelines from this area to the Coast were operating at capacity. Moreover, by January, Louisiana, which had increased production about 20 per cent in a little over two months, was approaching its maximum efficient rate of production.

But in addition to physical limitations on oil extraction and transportation, the slow increase in supply at the Gulf Coast almost certainly reflected a reluctance on the part of the state conservation bodies to augment allowable production. In the first place most oil men in the Southwest felt that a price increase was long overdue, in

[1] *Journal of Commerce*, October 16th and 17th, November 29th, December 11th, 1947.

view of the steady rise in costs of exploration and production which had occurred since the previous increase in 1953. Furthermore, had allowable production been increased enough to check the price rise, it would have proved most difficult, if not impossible, to cut back these allowables after the Suez reopened. So that in the absence of restraint by the state agencies in increasing allowables, reopening of the Canal might have seen a decline in the price of crude below what it had been before the Suez crisis. Indeed, the expansion of production which had already taken place may prove most awkward when the Suez is reopened and in fact this expansion makes it very doubtful that the recent price increase can be sustained.

Therefore, while members of the oligopoly temporarily have increased their control over price as a consequence of the Suez closure, the return of Middle East oil to the United States definitely will restore the market structure we have described in this paper.

V. SUMMARY AND CONCLUSIONS

We are now in a position to summarize our analysis of crude oil prices at the Gulf Coast.

Without doubt the Gulf Coast market can best be described as oligopolistic. The three principal producing states, each acting as a unit in extracting its oil, and the five international majors together supply a very large part of the U.S. market east of the Rockies. Supply is sufficiently controlled to provide the stable prices characteristic of oligopoly.

But it is doubtful that the members of the oligopoly can obtain much more than a short run stability in price. Each state and each of the international majors might like to act as a monopolist, restricting supply in order to raise price, but in fact the rivalry of all the states and the importers plus the continued entry of new wells into production has checked very much the possibility of obtaining limitations in supply. The states in the name of conservation may defend the rather dubious formula of supply limited to market demand and for a time they may have some successes in restricting production but the higher prices obtained very quickly will attract additional entry and the states will find themselves, as they did in the summer of 1956, attempting to force oil into the market in order to beat out rival states and importers and provide their own well operators with a satisfying allowable.

Under present circumstances, therefore, the consumer of petroleum products need not worry about the control over price which the producing states or the importing majors might exercise. Nor need anyone concerned with crude oil worry about control by the major

purchasers of crude. As buyers all of the major companies, including the Standard Oil Company of New Jersey, must go along with the market; they cannot remain competitive and pay more for crude oil than supply and demand conditions in the market require and they cannot maintain their connections while paying less.

Actually the biggest threat to the consumer at present is to be found in efforts of independent producers in the United States to obtain protection against imports of low-cost Middle East oil. In the past, however, congressional representatives of consumers on the Eastern Seaboard have been quite successful in withstanding moves towards protection.

It is not in the scope of this paper to consider alternative institutional structures for the production and marketing of crude oil. But those who are inclined to seek reforms will want to consider very carefully whether their proposals would improve on the present pattern which, though properly called oligopoly, is oligopoly sufficiently limited by rivalry and entry to be very close to a 'workable competition'.

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THE RELATIONSHIP BETWEEN WAGE AND EFFORT[1]

by W. BALDAMUS

THE increasing specialization of industrial economists and labour economists in recent years has had the unfortunate result that research findings of mutual interest are easily overlooked. This paper attempts to show that certain observations in the field of wage-policy may help towards a better understanding of the process of cost determination in the firm. As yet we do not know very much about the methods which are used in industrial practice to calculate the effect of wage costs on product prices. One factor of obvious importance is the variation of labour efficiency or 'effort'. From the standpoint of economic theory, it is usually sufficient to consider only those changes in the worker's effort which result from changes in his rate of pay. In the real world, however, the problem is complicated by the fact that effort is *also* affected by various *management controls*, such as methods of wage payment, time and motion study, methods of production and techniques of supervision. Moreover, different types of effort control are often used simultaneously. It is therefore difficult to isolate the specific effects of a particular form of control. How then is it possible for the entrepreneur to cope with the complexity of the problem? Although there is no simple answer, it will be seen that effort conceptions tend to become standardized and that these standards appear to be surprisingly stable. This facilitates the evaluation of effort considerably. The fact of the matter can best be shown in the case of piece rates, so these will be discussed first. After that we shall find that although the methods of effort control are different with time rates, the process of effort evaluation is essentially similar. Finally, some generalizations may be attempted which are independent of the methods of wage and effort control.

I

As far as piece rates are concerned, the evaluation of effort is based either on rate-fixing or on time study. While rate-fixing amounts to a combination of intuitive judgments with practical workshop

[1] This article is based on a survey of manufacturing firms which was made possible through the financial support of the Faculty of Commerce and Social Science of the University of Birmingham. The author is also indebted to Mrs. Eva M. Pritchatt who evaluated and arranged the material. A full description of the material will be published by Dr. H. Behrend in the *Industrial and Labour Relations Review*.

experience, time study is a systematically organized technique which requires special training in addition to experience. The following discussion will be devoted chiefly to time study, in view of its greater importance. My information comes partly from an analysis of published material (1). I am also drawing on a survey of some thirty-five manufacturing firms, centred on intensive interviews with production and personnel managers. Most of the questions in the interviews concerned the effectiveness of piece rates as a form of labour control.

The most striking feature of time study rationale is the contradiction between the claims which the practitioners make of scientific accuracy and their general admission of the extent to which their practice requires intuitive judgments. It is generally maintained — both in the literature and in practice — that for the effective administration of piecework, accurate 'time-standards', obtained by methods of time study, must be established. Everything, we are told, depends on the objective measurement of the exact time 'required' by a given worker for a given operation. And yet it is always admitted, though often reluctantly, that there are certain difficulties. The most serious one stems from the fact that the 'required' time cannot be defined without intuitive guesses as to what is in fact a 'normal', 'reasonable', 'fair', 'average' or 'right' degree of effort for any particular task.

This extraordinary mixture of measurement and intuition is expressed with equal consistency in statements from interviews and in published writings. I shall therefore simply quote from Lowry, Maynard and Stegemerten(1), the authors of the best known and most representative handbook (italics mine):

The aim of time study is 'to determine by scientific measurement the number of standard hours in which an average man can do the job' (op. cit. p. 8). 'In order to set *equitable* time standards for doing any task, it is necessary to establish certain criteria of performance. To this end, a *normal reasonable* performance called the average performance has been arbitrarily established by definition. It is the performance given by the operator who works with *average* effort . . .' (p. 9). The problem of average effort is discussed as follows: 'effort may be defined simply as the *will to work*' (p. 216). 'If . . . the time-study man is a good salesman and can show the man that the true purpose of time study is to establish *fair* time values under which increased earnings with increased effort are possible, and also that an *honest* effort on the part of the operator will help the time-study man to determine such time values, then the operator will be more likely to co-operate and to assist the time-study man to the best of his

ability' . . . 'The useful range (of effort) is divided into six general classifications: *poor*, *fair*, *average*, *good*, *excellent*, and *excessive*'. (pp. 216-17) . . . 'The average effort falls on the border line between the *fair* and the *good* effort. It is the effort to which all others are compared, and yet it is perhaps the hardest to define specifically. It is a little better than the *fair* effort and a little below the *good*. The operator exerting the average effort works *steadily* and with *fairly good* system. He will not deny that he is not doing his best, but he feels justified in holding back because he somewhat doubts the *fairness* of time-study or of the time-study man. These doubts may often be overcome in the manner discussed above' (p. 221).

It follows from this, as J. J. Gracie has put it, that 'time-study shows how long a job *should* take . . . and only incidentally tells how long a job *does* take' (2). But nowhere are we told how to determine the amount of time or effort which is too little, too much or just right. What we do find, again both in the technical literature and in the interviews, is a conception of 'loose' and 'tight' piece rates.[1] Loose rates occur when the right effort for a job has been overestimated by the time-study man. Payment per unit of effort is then too generous and the operator finds it easy to make exceptionally high earnings. When, on the other hand, effort has been underestimated and the most strenuous effort has little to show for it, the rate is tight. Clearly, these loose and tight rates can only mean one thing: that mistakes on the intuitive assessment of the right effort can be discovered, *after the event*, from the worker's behaviour.

The interviews show that there are many ways in which tight and loose rates are re-adjusted, but the underlying pattern of trial and error is always more or less the same. (The strategic questions were: 'Do you know cases of loose or tight rates? Are they tolerated? If so, why?'). As far as tight rates are concerned, it is usually assumed that the worker has the right to appeal, through the shop steward, to have the job re-timed. Loose rates, however, are difficult to correct because 'rate-cutting' is nowadays considered unacceptable, either by a tacit understanding, or on the basis of special clauses in collective agreements. It is nevertheless permissible to change the method of work and then to re-time the job. Often the dilemma is solved, alternatively, by a process of bargaining: the union agrees to the tightening of a loose rate if, in another job, a tight rate is replaced by a more generous one. No established criteria, defining the 'right' relationship between effort and pay, are ever mentioned. We are merely assured that it *can* be discovered, in practice, if the time-study

[1] Cf. for instance, Lowry, Maynard and Stegemerten, op. cit., pp. 10ff; John W. Hendry, *A Manual of Time and Motion Study* (London 1946), p. 58.

man has sufficient experience, training and familiarity with the conditions of the job being timed.(3)

II

How shall we interpret these observations? What, in particular, is the meaning of correctly set rates? Here we must first remove an obvious misunderstanding: the right rate is not merely a matter of accuracy in the sense of stop-watch measurements during the process of timing. Much more important is what goes on behind the scenes: the tentative evaluation of the right effort. Unless there is a tacit agreement between the parties concerned, or even a frank discussion about it, the timing procedure itself would be useless. It is quite evident that this tentative approach to effort values implies a normative orientation. And if this is so, it is only logical that the wage rate, too, is perceived in similar terms of moral attitudes. The search for a just rate is therefore subject to bargaining processes or other adjustments which may lead to some agreement as to what is tight or loose, stingy or generous. Clearly there must be a margin within which a rate can move up or down before it is valued as loose or tight. It seems plausible to argue then, that workers tend to value any rate as tight, and management any rate as loose: but each side pursues its interests only *up to a point*. Eventually management no longer presses for a lower rate and the worker no longer demands a higher one, for a given degree of effort. Then the rate is neither too loose or too tight and we have a condition which I suggest we call '*wage-effort parity*'. The term 'wage parity' was first used, in a wider sense, by Arthur M. Ross(4). Both the terms 'equity' and 'fairness' are useless for the present purpose as they unavoidably involve comparisons between gross earnings.

It is not difficult to see what constitutes the lower limit to the wage rate from the worker's point of view. His notion of tight rates results from two magnitudes which are stabilized in his mind: weekly gross earnings and maximum effort. He sets himself a fixed goal, say, £10 weekly, and he evaluates his habitual effort in a similarly rigid way. From past experience he knows the maximum degree of effort which he finds tolerable. Unless the unit wage rate satisfies these conditions, he will restrict output or look for another job. Evidently, under modern conditions of work, the upper limit to effort may be considerably below the physiological capacity of a worker.

It is much more difficult to understand the loose rate, that is to say, the lower limit to wage rates. Taking the goal of overall earnings again as more or less fixed, the worker must have some idea about the minimum effort to which he is committed. In extreme

cases, when a rate seems to him very loose, he may indeed feel a moral obligation towards his employer to have the job re-timed. We were told, for instance, that on one occasion a group of machine-operators volunteered to return to the firm a certain proportion of previous earnings because they thought the rate was excessively loose. Normally, however, it is the fear of potential rate-cutting which determines minimum effort. Fear of unemployment has also some effect when there is a prospect of redundancy.

But all this still leaves the problem of wage-effort parity rather uncertain. It may be further illuminated by considering different types of workers. As is well known, habitual expectations, both of gross earnings and effort limits, vary according to age, sex, social origin, past experience, training, type of work and region. Thus, while for any particular worker these expectations are comparatively stable, considerable differences become noticeable when one compares different job-situations. This explains why the routines of successful rate-fixing, time study and job-evaluation require much experience and close familiarity with the technical and physical working conditions. It is therefore not surprising that wide discrepancies in the rating of effort among different practitioners occur, when the rating is done under unfamiliar conditions which are artificially created for experimental purposes (5).

Furthermore, it is clearly important to distinguish between comparatively stable and changing situations. When workers, and time-study men, are dealing with conditions of work and earnings which have remained unchanged for some time, it is fairly easy to discover wage-effort disparities from the workers' reactions during the process of timing. In that case, the relevant expectations tend to become *standardized*: everybody is familiar with the prevailing notions of effort and earnings customary in that situation. Although even here effort cannot be measured in absolute terms, it is certainly possible to make *relative* judgments with regard to different jobs and different people. Standards of effort and earnings can then be treated as practically inflexible, and unit wage rates as adjustable. For in trying to discover the 'correct' rate, the two (major) alternative adjustments — restriction of output and change of production methods — are used only as a last resort.

But of course, conventional standards, along with the established wage-effort parities may have to give way to the pressure of changing market conditions. Disparities will become larger and more frequent, disputes more serious. If, for example, the supply of labour for a given job (or industry) becomes scarce, workers are in a position to exercise a pressure on wage-effort parity towards looser rates, by

restriction of output, working to rule, strikes, increasing absenteeism and so on. If the supply tends to be abundant, they will gradually adjust their expectations in the opposite direction. They would then be willing to work comparatively harder without corresponding improvements in pay. The position is essentially similar if the disturbing change comes from the product market. When the market expands rapidly, and the firm's demand for labour increases, management may attract labour by offering what amounts to relatively loose rates. Increasing competition in the product market, on the other hand, means that the existing rates have to be tightened, if necessary by concealed rate-cutting through changes in production methods. Occasionally, a trial period may have to be arranged for that purpose, until the changed conceptions of required effort have settled down into new standards. It is also possible to maintain wage-effort parity for the main part of a job-situation, but at the same time deliberately permit a fringe of minor disparities for the sake of flexibility in industrial relations. Overtime pay is often used in that sense, for it is usually conceived as an extra income that more than compensates the extra effort or discomfort. The rotation of 'gravy-jobs' and 'stinkers' is another example, as observed by D. Roy (3. p. 436).

Apart from parity and disparity of wage rates, we may further distinguish between different *levels* of wage-effort parity. Even if one assumes that disparity always tends to be a temporary situation, it is still possible that there are, at parity, variations in standardized expectations concerning the right degree of effort and, correspondingly, in wage rates. The practical importance of this is considerable. It is known, for example, that the process by which pay is aligned to effort varies according to the size of plant or firm. There is a tendency for small, owner-managed plants to operate on a relatively low level of effort, with low rates of pay, chiefly in the form of time rates. Here the average tempo of work and the whole atmosphere of effort control is rather lax and flexible. These firms attract workers who habitually prefer a low degree of exertion and are prepared to accept moderate rates of pay. In large firms, on the other hand, where a thoroughly organized pattern of production control prevails, the level of wage parity tends to be higher.

III

One might expect, then, that the concept of wage-effort parity need not be limited to piecework but has general validity, quite independent of the method of payment. Since I defined the concept on the basis of a relationship between effort and wages in the widest

possible sense, there is no reason why it should not also be applied to time rates.

To make the comparison between daywork and piecework valid, it must be realized that any kind of piecework always contains two elements: an agreement, however tacit, between employer and employee on what constitutes the correct level of wage-effort parity and, secondly, some form of effort control to make the agreement effective over time. The second element is easily overlooked, for under piecework the control is largely left to the worker. Once the right effort intensity and the correct price for it has been discovered and agreed upon, the employee will, on his own account, exert himself to reach certain targets, and will continue to do so in the same way indefinitely, as long as the wage rate remains adequate from his point of view. He is left to himself. Personal supervision is reduced (though quality control may be added or intensified). With daywork one finds exactly the same two elements, but here the second component, the control over effort, is more obvious. The agreement (and the bargaining) about the right relationship between effort and pay is concealed, particularly from the outsider. It is up to the foreman or supervisor to make sure that the worker's effort is adequate, relative to what he is paid. Thus even here there may be loose or tight rates. It is moreover possible for various levels of wage parity to exist. Strict supervision, and therefore intensive effort, tends to go with comparatively high wages, while slack supervision and low effort are adjusted to low wages. This is clearly illustrated by the following statement of a worker which I quote from an investigation by A. W. Gouldner (op. cit., p. 32): 'I like it here. They don't push you around . . . The Company knows that if they started getting tough around here, they would have to pay higher wages . . . The pay is like a balance for the working conditions. It sort of balances things.' The situation is no different when gang work, flow production or mechanical pacing determines the rate of work, for here too varying conceptions of a fair reward for the right rate of work must be agreed upon and put into effect. In short, all personnel controls of the firm have the same objective — to secure the maintenance of wage parity at a given level.

Thus the establishment of wage-effort parity is conceivable as a *general* process, regardless of the method of effort control. The difference between time-rates and piece-rates is merely a matter of degree in so far as the process of trial and error is more conscious and systematic in the case of piece-rates. By taking differences in the level of wage-effort parity into consideration, the concept becomes sufficiently generalized to be applicable even to the comparison of differ-

ent jobs, occupations, methods of production and so forth. This puts us in a position to define, or if preferred, to discard the vague notions of 'fairness' 'or equity' in respect of relative gross earnings. We may say, for instance, that the wage differential between two jobs is 'fair' if each fulfils the conditions of wage-effort parity and 'unfair' if at least one is a case of disparity. When a semi-skilled machine operator earns more than a fully skilled toolmaker, both would still consider it fair as long as wage-effort parity in terms of relative effort levels is maintained.

IV

Though in the past effort valuations have been treated as mere data, irrelevant to theory, their existence has not been entirely overlooked. We may recall that Marshall recognized the problem of effort estimation and 'prevailing standards' in connection with his theory of net advantages. 'Vigour', he states, 'works itself out in so many forms that no simple measurement of it is possible. But we are all of us constantly estimating vigour . . . Business men, even in different trades, and University men, even when engaged in different studies, get to estimate one another's strength very closely' (6). How this is in fact done is explained in a footnote which, although in a slightly different context, is directly relevant to our problems: '. . . there are scarcely any trades in which the amount of exertion which he (the labourer) puts into his work is rigidly fixed. If he be not able or willing to work up to the minimum standard that prevails where he is, he can generally find employment in another locality where the standard is lower, while the standard in each place is set by the general balancing of the advantages and disadvantages of various intensities of work by the industrial population settled there' (ibid. book VI, chapter II, paragraph 2, footnote 2).

While it is evident that there are still large gaps in our knowledge of the rôle of wage-effort parity in the determination of costs, it may be useful to formulate tentatively what we do know about it.

We know, first of all, that the whole sphere of effort and wage control (e.g. supervision, methods of payment, production methods, amount of pay) is saturated with normative conceptions about what is morally 'right' or 'wrong'. This is well documented, from the standpoint of general wage policy, in a recent study by Barbara Wootton on the British wage and salary structure (7). How these normative attitudes arise, is a sociological problem which cannot be pursued here. To put it very briefly, they stem from primary and secondary processes of 'socialization' in the sociological sense of the word (8). It means that we all aquire our moral standards primarily in early childhood from the social environment of the family in which

we are brought up. For example, it has been shown that the social background of the typical 'ratebuster' is very different from that which characterizes the 'chiseler' (9). The basic values which are so acquired tend to become further differentiated and further articulated through the effect of secondary socialization, that is to say, through the influence of education, training and occupational experience. These secondary processes are of particular interest to the present problem. In the course of the day-to-day interactions between workers in a given situation, and between workers and management, normative attitudes become standardized as a result of mutual adjustments in current conceptions of effort and earnings. Thus, the accepted standards define 'proper' behaviour within a prescribed range of upper and lower limits to wage-effort parity. Within that range, there is some degree of solidarity of interests; outside it, there are the familiar aspects of industrial conflict. Standards, in other words, are capable of providing stability-conditions in a situation which is generally surrounded by social conflict.

Moreover, as the evidence on parity standards suggests, normative conceptions have another peculiarity. They bring about a curious synthesis between analytically different components; notions about wages become fused with notions about effort, and vice versa. This, in fact, is the most arresting aspect of all parity and disparity conceptions. It follows that the existence of such 'synthetic' elements enormously facilitates the determination of labour costs from the businessman's point of view. He is not confronted with the hopeless task of discovering the marginal contribution of a unit of homogeneous effort to productivity. All he has to do, and all he can do, is to look around for the actual distribution of loose and tight rates at a given moment, for they alone are the strategic variables which enable him to discriminate at once between those components of the production process which are comparatively profitable and those which are not. Nor is it necessary in the normal run of affairs — as far as labour costs are concerned — to ascertain the specific effects of different methods of production, supervision and payment in absolute terms. For we have seen that profitable and unprofitable wage-effort disparities are observable in any situation, disregarding the *level* of disparity (or parity) in terms of real effort and actual earnings per unit of real effort. Only during major changes in market conditions are such comparisons required. As far as the available evidence goes, the problem is solved by trial and error. Although this question demands more extensive observations, we know at least what to look for.

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FLOUR PRICING AND THE MILLER'S MARGIN[1]

by Joyce M. Bellamy

I. INTRODUCTION

The abolition of the Government subsidy on bread in September 1956 has focused attention on flour prices. It seems appropriate, therefore, to review those factors which are taken into account in the determination of flour prices. Data published during the period between August 1953, when the United Kingdom flour-milling industry was released from Government control over wheat purchases, and September 1956 when the bread subsidy was finally withdrawn, has been used in conjunction with material relating to the organization of flour supply and demand, to stress the factors involved. Prices of flour and wheatfeed — the by-product from the milling of wheat into flour — are compared with the quoted prices of wheat to show estimated trends in the gross margin for the milling industry as a whole during the period under review.

TABLE I

SOURCES OF UNITED KINGDOM FLOUR SUPPLY

	Average 1934–38		*1953*		*1954*		*1955*		*1956**	*Index 1955 (1934–38 = 100)*
	th. tons	*%*	*th. tons*	*%*	*th. tons*	*%*	*th. tons*	*%*	*%*	
Home-milled	3876	90	3991	89	3822	91	3769	92	91	97
Imported	420	10	480	11	361	9	345	8	9	82
	4296	100%	4471	100%	4183	100%	4114	100%	100%	96

*January to September 1956.
Sources: *Annual Abstracts* and *Monthly Digests of Statistics; Trade and Navigation Accounts.*

II. FLOUR SUPPLIES

The United Kingdom flour supply is derived from about 300 mills located both at ports and inland centres, and also from Canadian, Australian, French and American imported flours. During 1954-56

[1] This article is based on material collected for a study of the British Markets for Flour and Wheatfeed made possible by a grant to the Department of Economics, Hull University, under the Conditional Aid Scheme for the use of Counterpart Funds derived from United States Economic Aid.

The author is indebted to the many members of the flour-milling, baking and biscuit industries, grain and flour importing trades and Ministry of Agriculture, Fisheries and Food who have been willing to discuss and comment on the various sections of the study, and also to Professor Bowen and members of the staff of the Economics Department, Hull University, for their helpful criticism on a number of points.

home-milled flours accounted for 91-92 per cent of the total flour supply. Table I shows that during the same period imports represented a smaller share of the total than the average for 1934-38. The total flour supply was 4 per cent less in 1955 than in the pre-war period and reflects the overall decline in demand. In 1955, for example, the per capita consumption of flour was 182.4 lb. per annum compared with 194.5 lb. in 1934-38. There are many different varieties of flour whose qualities and characteristics vary according to the types of wheat used and the nature of the final product, e.g. bread, biscuits, cakes, plain or self-raising flours for domestic use and a number of industrial purposes. The overall decline has not applied equally to the various types. Developments in the production of bread and flour confectionery in the large plant bakery, for example, have increased the quantities of flour used by professional bakers for bread production and the demand for biscuit flours has risen from 3 per cent to 7 per cent of total flour disposals between 1935 and 1955. (Table II)

TABLE II

ANALYSIS OF UNITED KINGDOM FLOUR USAGE

	1935	*1955**	*1935*	*1955*
	thous. tons		*flour disposals*	
For the manufacture of:			%	%
Bread	2,340	2,672	53	63
Flour Confectionery	275	450	6	11
Biscuits	148	290	3	7
†For domestic and miscellaneous uses	1,560	798	35	19
Exports	130	13	3	‡
Total disposals	4,453	4,223	100%	100%

†Includes self-raising flour, plain flour for domestic use, flour used in animal and other food manufacture, catering establishments and non-food uses.

*Estimated figures. The slight discrepancy between total disposals and total flour supply (Table I) is due to a time lag in the reporting of imported flour arrivals, and stock changes.

‡Less than 1%.

Sources: *Census of Production, Monthly Digests of Statistics,* Ministry of Agriculture, Fisheries and Food, and Trade Associations.

The volume of self-raising flours for domestic use is also higher than in the pre-war period; these flours represented about 4 per cent of total disposals prior to the war and about 8 per cent in 1955. Conversely, the demand for plain flours used for domestic bread baking has severely declined and is chiefly responsible for the downward trend in the miscellaneous group although the volume of flours for non-food uses has also declined from about 5 per cent of total flour supply in 1934-38 to approximately 1 per cent in 1954-55.

The national (subsidized) white and brown flours, which represented 71 per cent of total home-milled flours in 1955,[2] were used mainly for bread production and some types of confectionery. The Flour Order 1953 (S.I. No. 1282) specified that national flour should be of 80 per cent extraction or of substantially the same nature and contain the same proportions of constituents as flour of 80 per cent extraction. The extraction rate denotes the percentage of whole wheat grain which passes into flour; the higher the rate the more flour obtained.

United Kingdom millers use imported and home-grown wheats to produce the various types of flours. A higher proportion of home-grown wheats has been used in the post-war period although this has been declining since 1954. (Table III). Wheats are classified in terms of the hardness of their structure and are known as 'hard',

TABLE III

SOURCES OF WHEAT MILLED INTO FLOUR BY UNITED KINGDOM MILLERS

	Average 1934-38		*1953*		*1954*		*1955*		*Index*	
	th. tons	%	*th. tons*	%	*th. tons*	%	*th. tons*	%	*1956** %	*1955 (1934-38 = 100)*
Imported	4872	88	3625	72	3505	69	3759	73	79	77
Home-grown	660	12	1425	28	1575	31	1381	27	21	209
	5532	100%	5050	100%	5080	100%	5140	100%	100%	93

*January to September 1956. For the same period in 1955, home-grown was 25%.
Sources: *Monthly Digests of Statistics*; *M.O.F. Bulletins.*

'soft' or 'fillers'. The hard wheats (principally Canadian Manitobas) produce the strong flour which is required for baking an even-textured well-risen loaf. The soft wheats are grown mainly in Australia, France, the United States and Britain; they produce the weaker flours which are required for most biscuits, self-raising and confectionery purposes although they may be incorporated in varying proportions in the miller's grist for bread flours— the quantity used depending on their price and quality. The filler wheats are of medium strength, can be used with either hard or soft wheats as they do not affect the character of the grist and are imported mainly from South America, especially Argentina.

[2] See *Weekly Hansard*, No. 334, November 17th, 1955, p. 774. During the period under review at least 90 per cent of the United Kingdom bread supply was made from national flour.

Bread flours thus require a higher proportion of hard and filler wheats than most of the biscuit flours which are made mainly from the softer wheats. On average, a bread flour grist is made up of 70 per cent hard and filler wheats and 30 per cent of the softer varieties. The miller's choice of wheats for his grist is, therefore, determined by (i) technical factors such as the type of flour to be produced and (ii) economic factors, principally the relative costs of different wheats. The hard wheats, especially the higher grade Canadian Manitobas are more highly priced than the softer varieties.

Between 1954-56 nearly 80 per cent of the United Kingdom wheat imports came from Canada (54 per cent), the U.S.A. (14 per cent) and Australia (11 per cent); France accounted for 9 per cent and Argentina 8 per cent making a total of 96 per cent from these five sources. Comparable shares for 1934-38 were: Canada 39 per cent, U.S.A. 4 per cent, Australia 23 per cent; France 3 per cent and Argentina 16 per cent — a total of 85 per cent; the balance of 15 per cent was derived from the U.S.S.R., Roumania, Germany, India and at least 20 other countries. There has, therefore, been a change in the relative importance of the main wheat suppliers and in recent years, Canadian, North American and French wheats have increased relatively and absolutely compared with the pre-war period, and there has been a greater emphasis on a few sources of supply. Greater control has been exercised by exporting countries over wheat exports and their prices. For example, the Canadian Wheat Board is the sole seller of Canadian wheat and the Canadian Government establishes initial prices for basic grades. There has been little fluctuation in the prices of similar grades, although stocks have been increasing, and the f.o.b. (free on board) price has remained relatively stable over recent years. The U.S.A. has also held prices as far as possible by financing stocks with public money although during 1956 there have been some private arrangements for the disposal of surplus grain and U.K. imports of American wheat rose to 20 per cent of the total for all wheat imports in 1956.

Freight charges have increased, however, due to the demand for shipping space and, as these average between 15 per cent and 20 per cent of the total price paid by millers — in the case of Australian wheats freights may represent a third of the c.i.f. (cost, insurance, freight) quotation — they are a predominant factor in flour price changes. Since the price of wheat is the main element in millers' prime costs, changes in the wheat quotations are one of the principal factors affecting trends in flour prices.

Approximately 80 of the 300 flour mills in the United Kingdom are controlled by four organizations which are responsible for about

85 per cent of the total flour output of the country. These companies are primarily responsible for the bulk of the United Kingdom bread flour supply although they also engage in some production of flours from softer wheats and one company specializes in self-raising flours. The largest flour mills, owned principally by those companies, are located mainly at the eleven principal wheat ports[1] and use a high proportion of imported wheat in their grists. The inland millers and especially those located in the wheat-growing districts use English wheats principally and tend to specialize on biscuit, self-raising and confectionery flours. A 'soft national' flour has been made by some of the country millers from a grist of 20 per cent Canadian Manitobas and 80 per cent English; bakers have used this for blending with the stronger Canadian imported flours, which are made from the hard Manitoban wheats.

The supply of home-produced flour is supplemented by imports which, as Table I showed, amount to nearly 10 per cent of total supply. Imported flours are mainly used in bread production although some varieties are suitable for confectionery and may also be blended with home-milled supplies in the manufacture of biscuits and self-raising flours. They are not sold direct to the domestic market. Of the total volume of flour imported between August 1953 and September 1956, Canada supplied 74 per cent, Australia 18 per cent and other sources, mainly U.S.A. and France, 8 per cent. In 1934-38, Canadian flours were 48 per cent and Australian 30 per cent of the U.K. total; flours from a greater variety of other sources accounted for the remaining 22 per cent. During the period under review, most of the Canadian and Australian flours were of the 'national' grade at 80 per cent extraction in order to qualify for the subsidy paid on the home-milled national flours. Between 1954 and 1956 there has been an increase in the proportion of the total flour imports coming from non-Commonwealth countries. These flours, which are subject to a 10 per cent ad valorem customs duty (Commonwealth flours enter free of duty), accounted for 13 per cent of the total imports in 1956 compared with 3 per cent in 1954.

It is known that imported flours are not available in every area of the country, so that their influence in localized markets may be negligible. The usage of these flours is greatest in areas adjacent to the immediate hinterlands of the main ports of importation, e.g. London, Liverpool, Glasgow and Manchester which, in 1955, accounted for nearly 80 per cent of total flour imports. The demand

[1] These are: London, Liverpool, Hull, Bristol, Manchester, Glasgow, Newcastle, Leith, Belfast, Cardiff and Southampton, and in 1955 they accounted for 95 per cent of the U.K. wheat imports.

for imported flours is based, initially, on the relative competitiveness of their prices compared with those from home-milled sources for similar uses. It has been possible, at times, for bakers to blend the Canadian flour with either 'soft national' or Australian flours to give a lower price per sack than that of the home-milled national flour. In addition to the price margins between the imported and home-milled flours, however, imported flours must be of the right quality and consistency with an assurance of regularity of supplies. A baker or biscuit maker might prefer to buy home-milled if he cannot be certain that supplies will be regular, even if the price should be higher.

The imported flour trade has been affected by a narrowing of sources of supply and of outlets in recent years. The basis of trade on the selling side has become particularly difficult for the flour importer on account of the increasing control over bakeries by the large millers. The two largest millers have increasingly extended their interests in bakeries in order to ensure markets for a proportion

TABLE IV

WHEAT MILLED AND OUTPUT OF FLOUR AND WHEATFEED FROM UNITED KINGDOM MILLS

	Average 1934–38		*1953*		*1954*		*1955*		*1956**	*Index 1955 (1934–38 = 100)*
	th. tons	%	*th. tons*	%	*th. tons*	%	*th. tons*	%	%	
Wheat milled	5532		5050		5080		5140			93
Flour produced	3876	70	3991	79	3822	75	3769	73	73	97
Wheatfeed ,,	1650	30	1008	20	1232	24	1351	26	26	82
Flour and feed	5526	100%	4999	99%	5054	99%	5120	99%	99%	93

*January to September 1956.
Source: *Monthly Digests of Statistics*

of their flour output since the development of Allied Bakeries Ltd., which has become the largest bakery enterprise in the country. This organization has subsidiary companies throughout the United Kingdom and has purchased imported flours in 1954 and 1955. It is now one of the largest buyers in the markets for flour and especially bread flour. The two large millers have formed holding companies to organize their bakery purchases and are believed to have at least 60 bakeries under their control. The potential buyers of imported flour are becoming limited, therefore, to Allied Bakeries and the small baker, since the bakeries taken over by the millers are usually of the mechanized plant type.

III. WHEATFEED SUPPLIES

On account of ambiguities in the wording of the Flour Order, 1953, it was found that national flours were being milled at less than 80 per cent extraction. The Government Panel which investigated the composition of flour stated that the composition of national flour had changed from the equivalent of 80 per cent to about 74 per cent extraction due to the desire to produce a whiter flour.[4] Imported flours were still at the 80 per cent extraction rate and a member of the baking trade has indicated that this factor operated against imported flours since they were darker than the home-milled varieties. There was, in fact, a gradual decline in the average extraction rate during the period 1953-56; Table IV shows that this fell from 79 per cent in 1953 to 75 per cent in 1954 and 73 per cent in 1955 and 1956.

TABLE V

SOURCES OF UNITED KINGDOM WHEATFEED SUPPLY

	Average 1934-38		*1953*		*1954*		*1955*		*1956**	*Index 1955 (1934-38 =100)*
	th. tons	%	*th. tons*	%	*th. tons*	%	*th. tons*	%	%	
U.K. millers	1650	72	1008	73	1232	71	1351	80	84	82
Imports	647	28	380	27	493	29	343	20	16	53
Total	2297	100%	1388	100%	1725	100%	1694	100%	100%	74

*January to September 1956.
Sources: *Monthly Digests of Statistics* and *Trade and Navigation Accounts*.

A lower volume of wheatfeed was produced per ton of wheat milled during 1953-56 than in the pre-war period but the decline in the flour extraction rate since 1953 has increased the supplies of wheatfeed during the period under review. With completely free operating conditions however, the supply of home-milled wheatfeed is still relatively inelastic, since it is controlled within the limits set by (*a*) total consumer demand for flour, (*b*) the proportion of total flour supply represented by imported flour, and (*c*) technical and economic reasons which preclude the unlimited lowering of the extraction rate to satisfy a demand for wheatfeed.

Wheatfeed imports, which are subject to a 10 per cent ad valorem duty from non-Commonwealth sources, have represented a higher share of the total supply than in the case of flour (Table V) although this has been declining since 1954. The wheatfeeds, of which there

[4] See Report of the Cohen Panel on *Composition and Nutritive Value of Flour*. H.M.S.O. Cmd. 9757, May 1956, p. 18.

are several grades (e.g. bran, fine and superfine) are used principally in the manufacture of compound animal foods and the demand for them comes from a number of different sources. The most important of these are:

(i) companies which concentrate their whole production on the manufacture of these foods; they purchase all their ingredients, which in addition to wheatfeed, include oilseed cake and meal, fish meal, various cereals and other commodities, and are in business specifically to blend and sell feeding stuffs;

(ii) companies which produce animal foods with by-products from another part of their production; these are divided into (*a*) crusher-compounders and (*b*) miller-compounders. The crusher-compounders were originally concerned with marketing oilseed residues from the crush of oilseeds; they have outstripped domestic oilseed-meal production and are now buyers of cereals and cereal by-products (such as wheatfeed) and protein materials of vegetable and animal origin. About 128 of the flour mills are known to make compound feedingstuffs;

(iii) country manufacturers of feedingstuffs; these are agricultural merchanting businesses, trading with farmers in a variety of goods;

(iv) farmers who wish to blend their own feedingstuffs.

In the post-war years, demand for compound foods has increased and output has trebled from 2014 th. tons in 1945 to 6433 th. tons in 1955. A much higher proportion of the wheatfeed supply is, therefore, being used in compound foods than before the war. The demand for wheatfeed will, however, be affected by climatic conditions; for example, a severe winter or a wet summer will increase the demand, a good harvest reduce it. The usage of other feeding grains by farmers, e.g. barley, or changes in stock production and feeding methods can also reduce the demand.

Imports are usually available, but there is inevitably some delay between contract and arrival and they cannot be relied on to satisfy completely a sudden increase in demand. Conversely, an increase in the demand for flour will, automatically, produce a greater volume of wheatfeed and as millers are always anxious to dispose of their wheatfeed to avoid storage costs, they may be compelled to sell their by-products at lower prices in order to clear their stocks. A study of trends in wheatfeed prices during the period under review has given a number of examples of the effect of supply and demand on price.

IV. THE PRICING OF FLOUR AND WHEATFEED

All the large millers and most of the small are members of the National Association of British and Irish Millers. Four area associations cover England and Wales; these are affiliated to the National Association and have their headquarters at the four principal wheat ports of London, Liverpool, Bristol and Hull. The millers meet regularly (usually weekly) for the discussion of trade problems and the recommendation of prices of flour and wheatfeed. The replacement cost of wheat, and the prices which could be obtained for wheatfeed together with an allowance for operation costs and a margin for profit form the basis of the determination of the recommended flour prices, although account must also be taken of the prices of alternative supplies of flour from overseas sources, even though these represent less than 10 per cent of the total U.K. supply. Millers usually contract for their imported wheats about three months in advance of requirement so that current flour prices are influenced by the forward wheat quotations.

To guide members in their discussions, a booklet published originally in 1927 on the method of unifying costings for the industry, was revised by the British Millers Mutual Pool Ltd., to meet present-day conditions. A simple formula (confidential to the industry and not available for this study) was prepared so that members could use a standardized technique for arriving at the costs of production and the margins obtained after the sale of flour and wheatfeed. A system of deferred rebates to buyers of home-milled flour was introduced on a national basis in March 1954 and has been twice amended. These rebates may have tended to discourage bakers from using blends of imported and soft national flours which taken together were sometimes cheaper than home-milled flours. The rebates relate to flour purchases over a six-monthly period from all sources and bakeries must use about 100 sacks of flour per week to qualify for the lowest rebate on the scale (a sack of flour equals 280 lb.). The largest buyers, who, under the original scale saved 1s. 9d. on each sack were able, with the amended rates to save 3s. and subsequently 4s. 6d. a sack.

The practice of forward selling (known as 'bookings' in the trade) was re-introduced about a year after the de-control of the milling industry in 1953. The flour contract enables the miller to be certain of flour demand for a stated period (now 90 days). During the tenure of the contract, the miller may be purchasing wheat forward more cheaply and might also be getting a higher price for wheatfeed, but the baker would be tied to the same price under the contract

agreement. It is often at this stage that competition from imported flours becomes more apparent as the margin between home-milled and imported flour prices widens.

The millers stress that their recommended prices are not fixed ones and some of the smaller millers may charge less occasionally if this enables them to find new markets for their flour. Such practices are discouraged and references in the trade press have implied the need for all millers to keep together in their price policies even if they did not agree with the recommendations of their associations. An example of this was shown in 1955 when it was stated that . . . 'millers must support their local associations to the utmost and learn to carry out their wishes even if they were not always palatable to their individual likings'.[4]

It is obvious that the millers' own requirements for wheatfeed will be satisfied first (it has been estimated that they may account for about 25 per cent of the total demand for wheatfeed) but the remaining supplies are available for disposal to the large number of users. Prices are recommended for the various grades of wheatfeed but these are less strictly adhered to than in the case of flour. Since wheatfeed is used, almost entirely, as one of several ingredients in compound animal foods, the constitution, quality analysis and prices of which vary considerably some manufacturers of these can afford to pay more than others for their wheatfeed.

The size of the miller's margin depends, therefore, on (i) the extent to which he can cover his forward purchases of wheat by an assured market for his flour at a known price (by means of a contract arrangement), (ii) competition from other sources of flour supply which may cause him to reduce his prices, and (iii) fluctuations in the market for wheatfeed which will result in either a widening or narrowing of the margin over direct wheat cost.

In justification of their 'recommended' flour prices, members of the milling industry have stated that differences in the 'overall' costs of millers of different sizes are not large, on account of the similarity of purchase prices of wheats — the principal item in production costs — and owing to compensating factors in the transport of imported wheat inland and home-wheat to the ports. Flour milling is highly mechanized and labour costs are comparatively low; they were only 6 per cent of the gross output of specialist millers of wheat in 1951. Costs of production are affected by factors common to all mills, such as changes in wheat quotations, agreements on labour rates, etc. and also by the extent to which increased stocks are held and allowances made for capital depreciation. Although millers'

[4] See Report of the Birmingham Millers' Association, *Milling*, March 12th, 1955, p. 330.

'overall costs' do not vary widely, especially for those engaged on similar types of production, variations do occur, so that a recommended price, if rigidly applied, must give a higher margin to some millers than to others. It has been publicly acknowledged that . . . 'there was a perfectly sensible margin which was more profitable to some than to others but if it became too "skinny" the groups of millers contacted each other to make the necessary adjustment'.[6]

The published accounts of the milling companies are the only sources of information on the trading activities of individual millers. These cannot, however, provide a complete picture of the actual profit on the milling operation as other types of production, e.g. animal feedingstuffs, may also be included in the accounts. Furthermore, since only a few of the millers, principally the largest, are registered as public limited companies, it is impossible to obtain from company records any indication of the profit margins for the industry as a whole.

In view of the millers' pricing policies, it is not unreasonable to assume that an analysis of the basic published data on wheat prices and the quotations for flour and wheatfeed will provide some indication of general trends in the margin between average wheat cost (exclusive of transport charges from port or farm to mill) and the prices received for flour and wheatfeed (exclusive of rebates or sales on contract below the current quoted prices). Attempts have been made in the past to estimate the gross margin between average wheat costs and the prices of flour and wheatfeed.[7] A refinement of the methods used in these earlier studies has been applied to the available data for the period August 1953-September 1956 and in the following section the trends in flour and wheatfeed prices will be considered in relation to the average prices of imported and home-grown wheats.

V. ANALYSIS OF THE MILLER'S MARGIN

(i) *Trends in flour prices*

The actual prices paid for the different types of flours are unobtainable since they depend on whether the consumers (*a*) purchase sufficient quantities to qualify for rebate, (*b*) agree to purchase on a forward contract at current prices, (*c*) blend imported with home-

[6] See a report of an address by a miller to the Kingston Bakers' Association, *Baker & Confectioner*, August 5th, 1955, p. 232.

[7] See A. W. Ashby, 'The Miller's Margin', *Journal of the Royal Agricultural Society*, Vol. 85, 1924, covering the period from 1911-1923; H. V. Edwards, 'Flour milling', in *Further Studies in Industrial Organization*, ed. M. P. Fogarty, 1948, p. 55 for estimates from 1925-38.

milled, (*d*) make a special arrangement with an individual miller.[8] However, the weekly price recommendations for home-milled flours (bread, biscuit, bulk self-raising etc.) and the c.i.f. quotations of imported flours give some useful indications of general trends during 1953-56. For the purposes of this analysis, emphasis is placed on the trends in national flour prices since this type of flour accounted for at least 70 per cent of the total home-milled supply.

During the period under review, the price of national flour fluctuated between a maximum on de-control in August 1953 of 110s. 3d. a sack to a minimum of 89s. in the autumn of 1954. During the first half of 1954, Allied Bakeries increased their usage of imported flours and imports from Canada reached their highest level throughout the three-year period. The price of national flour declined from January 1954 to the end of March; it was then stabilized at 96s. a sack for 12 weeks but began to decline again in June and fell at frequent intervals to a minimum of 89s. in September 1954. Imported flours were in very short supply during the London Dock strike (autumn 1954) and the millers re-introduced their pre-war practice of flour 'bookings'. When imports were again available, demand had declined since many bakers had booked their flour requirements from home-millers and the margin between the home-milled national flour and the 80 per cent extraction Canadian flours widened. This margin proved attractive, imports began to increase and the price of home-milled flour declined.

During the period of the agreement between Allied Bakeries and the millers (October 1955-March 1956) flour imports were about 20 per cent less than the comparable period in the previous year and there was an increase in home-milled flour prices. National flour reached 103s. in January 1956 and this level was maintained for 9 weeks. The extent to which the highest prices were paid by bakers is not known as many flour contracts were in operation. The margins between the Canadian and home-milled national flours and the Australian, and flours made from English wheats widened and bakers became aware of the advantages of blending Canadian and Australian for bread making. For example, in March 1956, it was possible to buy imported Canadian at 103s. a sack (delivered) and Australian at 85s. a sack i.e. a total of 188s.; this gives an average of 94s. a sack compared with 103s. for home-milled national.[9] Although total purchases of imported flour were small compared with the former

[8] See the *Economist*, October 8th, 1955. A bakery company undertook to purchase a fixed minimum quantity from two millers and, in exchange, the latter agreed to give a special discount of 2s. a sack (equivalent to 16s. a ton). The agreement lasted six months.

[9] See *Baker & Confectioner*, March 30th, 1956, p. 541.

requirements of Allied Bakeries in 1954, they proved the value of imported flours in introducing a greater degree of competition in the market for bread flours than would have otherwise existed. In view of the increased margin between imported and home-milled prices there would, most probably, have been higher purchases of imported flour if the difference in the extraction rates and the existence of forward contracts had not discouraged the usage of imported flours on a large scale.

In Table VI the quotations for home-milled and imported flours have been expressed in tons for 1954-56. The imports are c.i.f. values to which must be added charges for dock handling, customs duty where payable, storage and transport to the consumer. The table shows that there has been a greater percentage increase in the quoted prices for home-milled national flour than for the Canadian imports and in the cases of Australian and other flours the average value of imports in 1956 was less than in 1954.

TABLE VI

AVERAGE PRICES FOR HOME-MILLED NATIONAL AND IMPORTED FLOURS

	(£ per ton)			
	1954 £	*1955* £	*1956** £	*Percentage change 1954–56*
Canadian†	36.14	37.06	37.55	+4
Australian	33.93	32.29	32.24	−5
Other sources	31.54	30.54	30.95	−2
Home-milled national	37.67	38.52	40.85	+8

*January to September 1956.

†These figures will include some Canadian flour of lower extraction than 80% but the proportion of the total is not large.

Sources: *Trade and Navigation Accounts* for c.i.f. values of imports.
Milling for quotations of home-milled national flour.

(ii) *Trends in wheatfeed prices*

The weekly quotations for home-produced fine wheatfeed have been compared with the c.i.f. values of imported wheatfeeds and considered in relation to the average weekly supplies of these milling by-products from home and overseas sources and trends in demand as indicated by total disposals of these by-products. Prices obtained by millers for their wheatfeed were, with few exceptions, at a higher level during 1955 than in the previous year. The average price for fine wheatfeed (home-milled) in 1954 was £24.3 per ton; in 1955 it was £27.6. During the first few months of 1956, the price of wheatfeed fell on account of an increase in supply in excess of demand, due

to a rise in the demand for flour. Subsequently prices rose; the average prices for August and September 1956 were £29.2 compared with £25.5 in 1954 and £25.6 in 1955 for the same period, i.e. over £3 a ton higher in 1956.

There have been a number of occasions when millers could sell their by-product for the same or higher prices than the average c.i.f. value of their wheats. Imports of wheatfeed have, on several occasions been responsible for reductions in home-milled prices, although at certain times, high prices for imported supplies have encouraged rises in home prices when demand exceeded supply.

The supply of wheatfeed cannot be completely elastic to price changes since the home-supply is controlled within certain limits but there has been some indication that the reduction in the extraction rate for the purpose of producing a whiter flour has been encouraged by the higher prices which could be obtained for wheatfeeds. Theoretically, in cases of joint production, if the demand for one of the joint products falls, the supply of both would be decreased unless the demand for the other rises sufficiently to enable the price obtained to carry a greater share of the cost. This would appear to have occurred in 1955 when, despite a decline in the total demand for flour, a higher quantity of wheat was milled than in 1954 at a lower extraction rate giving an increased supply of wheatfeed. (Tables I and IV).

(iii) *Trends in wheat prices*

The average c.i.f. value of Canadian wheat imports in 1954 was £28.130 per ton and for all imported wheats, £26.520 per ton. Wheat prices rose during 1955 giving an annual average for Canadian wheats of £29.379 per ton and all imported wheats £27.625. In 1956, there was a tendency for the prices of wheats from countries other than Canada (especially the United States and Australia) to increase proportionately more than those of the Canadian wheats so that the margin between the two groups was narrowed. The closure of the Suez canal, which increased freight charges, was responsible for rises in the forward quotations for wheat shipments at the end of the year but the average c.i.f. values of Canadian wheats for 1956 were about the same at £29.389 per ton, whereas the average for all imported wheats had risen to £28.339. Wheat imports from any source are free from customs duty.

Home-grown wheat prices declined steeply during the summer of 1954 from an average of £33.260 per ton during the first six months of the year to an average for the second half of the year of £23.093 per ton. Prices were as low as £20.3 per ton in October; this was due to a

poor harvest in 1954 and to competition from French supplies of wheat which were of better quality than home-grown and could be obtained as cheaply as the English varieties. Subsequently English wheat prices rose slightly but the average for the whole of 1955 was only £22.900 per ton. In 1956 competition from French wheats declined and the average price of English wheats during January-September 1956 was £25.779. The decline in Australian wheats compared with the pre-war years has been due to competition from similar types of wheat grown in England, France and other European countries.

(iv) *Trends in the Miller's Margin*

Two calculations of the miller's margin have been made.[10] In the first, estimated wheat prices for an average grist used for the milling of national flour (taken as 55 per cent Canadian, 10 per cent Australian, 15 per cent other imported wheats and 20 per cent English) are compared with the combined prices of national flour and fine wheatfeed. Allowances were made for the variations which occurred in the average extraction rate but none could be made for the transport of wheat or production costs. Estimates were obtained for the prices of wheatfeed by calculating these from the quoted prices for fine wheatfeed on the basis of approximate quantities of wheatfeed derived from milling a sack of flour. The price per sack of national flour was added to the calculated feed price and the margin between this total and the estimated wheat prices gives an index of gross margin. This index was then expressed as a percentage of the estimated wheat prices (Table VII, column A). These figures may not represent actual gross margins but they should indicate trends in the true margin.

In the second calculation (Table VII column B), account was taken of the total home and imported wheat milled into flour and of the total flour and wheatfeed produced. Estimated values of the wheats used and prices of the products derived from milling were combined with the quantities produced. Finally the total flour and wheatfeed values were added together and divided by the quantities of each produced to give an average price for the two commodities. From this average price was deducted the estimated wheat cost—the difference between the two representing the gross margin for the total output of flour and wheatfeed. This margin was also expressed as a percentage of wheat prices. Changes in these percentages should

[10] The basis of these calculations is among the points explained more fully in a more comprehensive text, which, together with some additional tables, will be issued by the Department of Economics, Hull University, in October 1957.

reflect variations in the gross margin accurately, except in so far as the factors used cease to be representative, for example, if there is an alteration in the average relationship between 'quoted' prices (as used in the analysis) and 'taking' prices (i.e. the quoted prices less allowances for sales made on a forward basis and rebates). In both calculations allowances have been made for the forward purchasing of wheat, for example, c.i.f. values of wheat imports in May would be related to the quoted prices of flour in February.

There are discrepancies between the two columns, due mainly to differences in the proportions of home and imported wheats used at certain periods of the year, but several trends are common to both calculations:

TABLE VII

TRENDS IN MARGIN INDICATORS FOR:
(A) NATIONAL FLOUR AND (B) ALL TYPES OF FLOUR
(expressed as percentages of estimated wheat prices)

	1953		1954		1955		1956	
	A	*B**	*A*	*B*	*A*	*B*	*A*	*B*
January			25	23	28	29	35	33
February			22	20	33	32	32	30
March			24	22	31	32	35	31
April			22	19	27	28	32	29
May			26	22	31	31	32	29
June			23	20	31	29	32	29
July			22	22	32	31	31	28
August			27	31	34	34	31	27
September	34		27	28	37	36	30	29
October	28		23	27	33	36		
November	26		26	27	31	31		
December	26		26	27	34	30		

*Data not available for September to December 1953.

(*a*) Both margins were lower during the first half of 1954 than at any other time during the period. This was because the increased importations of Canadian flour for use by Allied Bakeries compelled millers to reduce their flour prices when, on the basis of wheat costs, such a decline would not normally have occurred.

(*b*) Cheaper wheats, both home and imported, were available in the late summer and autumn of 1954 and the temporary reduction of imported flour supplies during the London Dock strike enabled the home millers to increase their share of the trade. At the same time, the prices received for wheatfeed began to increase. The margins rose and were maintained at higher levels during 1955 than in the previous year.

(*c*) During 1956 there have been fluctuations in the margin but, on average, the 1955 levels were being maintained. Flour prices were higher than at any time since September 1953, but average wheat costs had risen during the first six months of 1956 and average receipts from wheatfeed sales had declined (although during July, August and September 1956 the prices received for wheatfeed increased). Flour prices were raised, therefore, to prevent a decline in the general level of the gross margin.

An arithmetic example may be used to indicate the relationships which exist between the costs of wheat and the prices of flour and wheatfeed. A ton of wheat, milled at an extraction rate of 74 per cent could produce about 14.9 cwt. of flour and 5 cwt. of wheatfeed (making a small allowance for extraneous material removed before the wheat is milled). Expressed in terms of sacks of flour, the output from a ton of wheat would represent about 6 sacks of 280 lb. An increase of 2s. in the flour price per sack is, therefore, equivalent to a rise of 12s. in the price of a ton of wheat, if wheatfeed prices remain the same. Since wheatfeed produced at this extraction rate is equivalent to about one-quarter of the total wheat used, a decline of £1 in the price per ton of wheatfeed, would represent 5s. for every ton of wheat and thus reduce the receipts from the increased flour price to only 7s.

The methods of analysing the miller's gross margin have indicated the relative importance of the various factors outside the actual cost of milling operations which are responsible for fluctuations in the prices of flour. Biscuit and self-raising flours are influenced primarily by changes in the prices of English wheat but bread flours are affected, in addition, by the prices of those imported wheats which can be used in the grist for bread flours. In all cases, however, the prices which can be obtained for wheatfeed must be taken into account as well as trends in the alternative sources of flour from abroad.

VI. CONCLUSIONS

(i) Published data can, therefore, be used to analyse the relationship between trends in flour prices and the gross margin from milling wheat into flour and wheatfeed. It is not possible, however, to comment on the net margin since data are unavailable on most of the other costs of production.

(ii) During the period under review, the millers' gross margin appears to have increased because the estimated prices of wheat supplies did not rise to the same extent as the estimated receipts from sales of flour and wheatfeed.

(iii) The effect on flour prices when competition was reduced (i)

during the London Dock strike and (ii) during the time of the agreement between Allied Bakeries and the millers indicates that imported flours can influence trends in home-milled prices. The fact that a greater demand for imported flours did not occur may be attributable to the differences in the extraction rates of the home-milled and imported bread flours. With the continued expansion of the vertical integration of flour mills and bakeries, it is possible that, in the future, imported flours, especially for bread making may have less influence over home-milled prices. The existence of the potentially large buyer, Allied Bakeries, should, however, provide some encouragement to flour importers.

(iv) The factors, apart from milling costs, which have, therefore, influenced changes in flour prices between 1953 and 1956 are:

(i) Wheat costs, including increases in freight charges resulting from the increased demand for shipping space.
(ii) Trends in the market for wheatfeed.
(iii) Structural developments in both the consuming and producing industries — e.g. the increased power of the large millers as a result of vertical integration and the expansion of Allied Bakeries.
(iv) Competition from imported flours within the limits of availability, quality and price.
(v) Policies of the millers regarding rebates, forward contracts, etc.

The study emphasizes the need to examine trends in wheat prices and also the prevailing conditions in the market for wheatfeed before an explanation of flour price changes can be sought. Although the analysis cannot provide a complete picture of the relationship between flour prices and millers' profits, it does suggest that there is not always an immediate adjustment between millers' costs and receipts, especially if competition from alternative sources is reduced.

UNIVERSITY OF HULL

THE STATED QUALIFICATIONS OF DIRECTORS OF LARGER PUBLIC COMPANIES

by D. P. Barritt

This note is a by-product of the work of the Science and Industry Committee, a body appointed by the Royal Society of Arts, the British Association and the Nuffield Foundation to investigate the factors which influence the rate of adoption of new scientific and technical ideas in British industry. In order to study the relation between technical progressiveness and financial success, a standard of reference was set up by drawing a sample of 500 companies from Moody's company records.[1] This sample excluded firms mainly engaged in finance or distribution, and those whose main activities lie outside the United Kingdom; otherwise it was a random sample within the strata given by the Orders of the Standard Industrial Classification. The firms concerned are public companies with quotations on the London Stock Exchange, and are thus some of the larger public companies in British industry.

Having obtained this sample, it seemed sensible to use it, among other things, to examine the qualifications of directors; for the lack of relevant scientific and technical qualifications in the directors of many British firms has often been mentioned (for instance, by Sir Edward Appleton in his 1956 Reith lectures). Our inquiry was necessarily limited to the stated qualifications which appear on company reports (and are thus reproduced on Moody's records), or which are otherwise easily discovered, for instance in the *Directory of Directors*. It is therefore essentially an inquiry into the holding of degrees and membership of professional bodies; and we fully appreciate that in some trades 'qualification by experience' commonly takes the place of such formal qualifications, and that in others the relevant professional membership is not usually indicated by letters placed after the name. Some directors undoubtedly have formal qualifications not stated in the sources we used, and these omissions will be most likely for qualifications which do not suggest special technical competence in the business. We have tried to remind readers of the limitations of our inquiry by using the term 'stated qualifications'; we think that these are, in some industries at least, important enough to warrant the analysis.

[1] Made available to the Committee by the kindness of Moody's Services Ltd.

The stated qualifications were classified as:

1. Professional qualifications apparently relevant to the manufacturing technique of the business (but excluding the classes below):
2. University science degrees (where distinguishable):
3. Other University degrees:
4. Financial, secretarial and miscellaneous qualifications. These were mostly qualifications in accountancy.

The numbers of stated qualifications exceed the number of 'qualified' directors, since one director may have several stated qualifications.

Table I shows the average number of directors with stated qualifications per firm, for three sizes of firm as defined by the value of net tangible assets in 1955:

TABLE I

DIRECTORS WITH STATED QUALIFICATIONS, BY SIZE OF FIRM

Size (Net tangible assets, £000)	*No. of firms*	*Average no. of directors per firm*	*Average no. of directors per firm*				
			With any stated qualification	*Class 1 'Professional, relevant to technique'*	*Class 2 'Stated science degrees'*	*Class 3* 'Other degrees'*	*Class 4 'Financial etc.'*
0-500	125	5.00	1.22	.36	.10	.18	.72
500-2,000	202	5.70	1.39	.48	.20	.23	.65
Over 2,000	173	7.38	2.05	.85	.27	.40	.85
All firms	500	6.10	1.57	.58	.20	.28	.74

* Some of these degrees may, in fact, refer to scientists, due to the practice of some universities awarding the first degree as a B.A. whether the examination is in Science or in 'Arts'.

There were 100 firms with *no* directors having stated qualifications; the average number of directors with stated qualifications in the remaining 400 was thus 1.96. The average number of directors per firm, 6.10, agrees reasonably well with G. H. Copeman's figure of 7.22 in his survey[2] of 445 companies, made in 1951, since he was dealing only with firms with assets exceeding a million pounds; it will be seen that larger firms had somewhat more directors. But only 7.8 per cent of directors are recorded as having University degrees, whereas Copeman found 36 per cent who had attended a University. It is probable that our figure is too low, by omission, and that Copeman's was too high, for he was working by direct questionnaire with a response rate of about 39 per cent, and it is probable that the response was lower from the less well educated directors. R. Stewart, in a study[3] of 50 companies for the Acton Society Trust, found that

[2] G. H. Copeman, *Leaders of British Industry*, Gee, 1955, p. 76.
[3] R. Stewart, *Management Succession*, Acton Society Trust, 1955.

19 per cent of *managers*, and 33 per cent of *top managers*, had been to a University.

21.6 per cent of the directors had stated qualifications other than University degrees. Copeman's most nearly corresponding figure is 27 per cent, but this includes 4 per cent who attended Service colleges and 1 per cent with ill-defined qualifications, such as learning languages on the Continent, which would not be stated. There is thus reasonable agreement in the estimates. Sargant Florence, in a study[4] of 436 public companies, found 6 per cent of the directors to be accountants, 2½ per cent lawyers, and 4 per cent with other technical qualifications. These figures relate to companies taken from the *Stock Exchange Year Book* for 1936; in the largest companies (capital exceeding £500,000) technical men were 4.2 per cent and accountants 7.6 per cent of all directors. These figures appear in comparison to ours, to be too low, though it is probable that the qualifications of boards of directors have improved since 1936. This improvement would tend to make itself felt more rapidly among *managers* as in the Acton survey, than with *directors* where the post-war influence of increased University and technical training will be subject to a longer time lag.

TABLE II

DIRECTORS WITH STATED QUALIFICATIONS, BY INDUSTRY

Industry	*Standard Industrial Classifications*	*No. of firms*	*No. of directors*	*Percentage of directors*				
				With any stated qualification	*Class 1 'Professional, relevant to technique'*	*Class 2 'Stated science degrees'*	*Class 3* 'Other degrees'*	*Class 4 'Financial etc.'*
Chemicals	(4)	31	219	21.5%	10.1%	6.4%	4.1%	9.1%
Engineering	(6)	89	558	37.5	22.2	5.4	4.5	11.3
Vehicles	(7)	30	177	36.7	14.1	4.5	6.8	11.9
Other metal industries	(5)(8)	50	255	27.8	11.4	4.3	5.5	11.0
Textiles	(10)(11)(12)	85	574	18.5	3.3	1.7	3.1	12.4
Food, drink	(13)	80	393	23.4	1.3	2.0	6.4	17.8
Paper, printing	(15)	30	213	16.0	0.5	1.9	2.8	11.7
Transport, communications	(19)	8	52	32.7	19.2	3.9	1.9	11.5
Building and building materials	(3)(14)(17)	46	267	23.6	8.6	1.9	4.1	10.1
Other industries	(1)(2)(9)(16)(18)(20)	51	341	24.3	9.1	2.0	5.0	11.1
All industries		500	3049	25.8	9.5	3.2	4.5	12.1

* See note to Table I.

[4] P. Sargant Florence, 'The Statistical Analysis of Joint Stock Company Control', *Journal of the Royal Statistical Society*, Series A, 1947, pp. 15, 16.

Table II shows how the proportion of directors with stated qualifications varies by industry.

This table shows a higher proportion of stated technical qualifications in engineering and transport; the expected higher proportion of science degrees held by directors in the chemical trades; and a large proportion of 'financially' qualified directors in the food and drink trades.

One conclusion of the main study[8] was that 'technical progressiveness' as judged by the Committee's investigators (which was in turn found to be related to twenty-four other characteristics of the firms) showed some positive relation to the percentage increase of trading profits, comparing the financial years ended 1952-55 to those ended 1948-51; whereas there was little relationship between technical progressiveness and two alternative financial criteria which were tested, profits as a percentage of fixed assets and stocks, and the

TABLE III

DIRECTORS WITH STATED QUALIFICATIONS, ACCORDING TO COMPANY PROFIT RECORDS

	50 firms with best profit records		*50 firms with worst profit records*	
	Number of directors	*Difference from expected number*	*Number of directors*	*Difference from expected number*
Total directors of the 50 firms	311	+6	297	−8
Directors with any stated qualification	96	+8½	54	−9
Directors with stated qualifications in:				
Class 1, 'Professional, relevant to technique'	45	+7	17	−2
Class 2, 'Stated science degrees'	18	+8½	7	+ ½
Class 3, 'Other degrees'	15	+2½	7	−4½
Class 4, 'Financial etc.'	38	+3	34	−4½

rate of increase of assets. There is therefore some interest in comparing companies which show a large percentage increase of trading profits with those which show a small increase or a decrease. The 500 companies were ranked according to this criterion, and the top and bottom 50 were isolated, being described as the groups with the 'Best profit record' and 'Worst profit record'. These groups differed from the average of the whole 500 companies in industrial and size distribution; thus, there was an undue proportion of textile firms in the 'worst profit record' group. In the table given above, therefore, the actual numbers of directors are compared with the approximate

[8] C. F. Carter and B. R. Williams, *Industry and Technical Progress*, Oxford University Press, 1957.

numbers which would be expected, in a group of the given industry and size composition, on the basis of the results from the whole sample of 500. In other words differences due solely to different industry and size distribution are as far as possible eliminated.

The firms with good profit records have more directors, but this accounts for little of the striking divergence between the two 'difference' columns. The temptation to make bold steps of reasoning is strong: profit record is allied to technical progressiveness: firms with a good profit record have more directors with *stated* qualifications, and therefore perhaps more with *any* qualifications: therefore the employment of qualified directors is either a cause or a result of technical progressiveness. The data are by themselves too flimsy to support such deductions, but the deductions are broadly (though in a more complex form) confirmed by the main study of which this is a by-product.

THE DEPARTMENT OF ECONOMICS,
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SELECTED STUDIES IN ALTERNATIVE MAN-HOUR COSTS

FOREWORD

by Professor Seymour Melman

These studies in alternative production methods and costs originated as projects in the course on Industrial Economics in the Department of Industrial and Management Engineering at Columbia University. This course emphasizes the problems of defining the relation of industrial inputs to outputs, especially under changing cost conditions. Accordingly, the causal processes which determine the change of production methods are a central subject for instruction. This is the nuclear aspect of the change in industrial productivity.

Each student is required to analyze the changes in costs of doing work by means of alternative production methods. My experience is that these cost studies form a most important part of the learning process, for the student verifies the generalizations of the lecture materials by manipulating data on production processes of his own choice.

In these cost studies, the student sees, through data that he has fashioned, how the changing costs of labor and of machinery govern the relative costs of production by available methods. The dynamic view of cost changes is an important instrument in the industrial engineer's work of designing production operations that must be economic under future cost conditions. Cost analyses, of the type shown below, equip the student with the bases from which estimates can be made of preferred production designs for forecasted cost and volume conditions.

The reader will notice that only 'close to production' costs have been included in these estimates. That is owing to the fact that given production equipment may be operated under varied decision-making arrangements. Various intensities of managing involve variation in such costs. Moreover, overhead costs may be applied to machines on several bases (machine prices, floor space, operator wage cost, etc.) which yield varying cost allotments to given equipment. Accordingly, in the effort to expose the underlying pattern of shifting costs of alternative production methods, managerial and related overheads do not appear in these cost studies.

I. THE PAINT SPRAYING OF ELEVATOR PARTS

by A. CALDERARO

Introduction: The elevator parts to be sprayed are carried by a chain conveyor through a spraying booth where the painting is done. The spray booth and conveyor are not represented in the alternative cost calculations because they will be utilized in both methods.

A. *The 'Hand' Method*: The operator paints the pieces with a spray gun as they pass through the booth. The operator directs the paint towards the piece and regulates the flow of paint. Compressed air in the gun atomizes the paint and impels it towards the part to be painted. The operator has two air guns, one on each side of the booth, and is able to paint both sides of each part before it leaves the booth. The equipment used in the hand spray operations is: 2 Air guns; 1 Suction feed; 1 Air transformer; 1 10-gallon pump.

The hand-spray method of painting elevator parts has not substantially changed in the last 30 years or more, and is the method still in use in the factory where the study was made.

B. *Electrostatic Spray Method*: With this method compressed air is not necessary; the paint is pumped at a given rate to the electrostatic spray gun. A source of electrostatic high potential, with one terminal connected to the spray gun, creates an electrostatic field between the spray gun and the parts to be painted, which are grounded by the conveyor. This field causes the spray of charged paint par-

TABLE I

PURCHASE PRICE OF EQUIPMENT DURING SELECTED YEARS

(a) *Hand Spray Equipment*

Item	*1929*	*1955*	*% Change*
Spray gun (two)	$ 34.00	$ 88.00	
Suction feed	3.10	8.00	
Air transformer	24.50	63.50	
10-Gallon pump	136.00	350.00	
Total	$197.60	$509.50	168%

(b) *Electrostatic Spray Equipment*

Item	*1955*
140kv Power supply and pump	$4860.00
Ionic gun (two)	276.00
High voltage insulator (two)	81.00
Total	$5217.00

Note: Prices are for equipment delivered at point of use.

ticles to be attracted to the parts to be painted. Different electrostatic field patterns can be obtained to assure complete coverage of the parts. With this method operating labour is not necessary because the electrostatic field directs the paint towards the part and the flow of paint is regulated by the pump.

Years Selected and Data Used: The factory studied has used the hand-spray of elevator parts by the methods described since 1929. 1929 was therefore selected as a base year for the discussion of the cost of hand spraying and a comparison with the cost of electrostatic spraying was made for the year 1955.

Prices of equipment bought in 1929, average hourly earnings of production workers, and cost of electrical energy to industrial users were available in the records of the company.

A complete unit for electrostatic spraying is sold as a 'package' by a Garfield, New Jersey, manufacturer and the prices of this brand of equipment were used in the 1955 cost comparison. A similar unit is made and leased by another manufacturer but this alternative has not been considered.

TABLE II

HOURLY COST OF OPERATION OF THE EQUIPMENT AT EACH DATE

Cost Category	*1929 (Hand Spray)*	*1955 (Hand Spray)*	*1955 (Electrostatic Spray)*
Total Investment	$197.60	$509.50	$5217.00
Annual Charges			
Depreciation[1]	39.50	101.90	1043.40
Repairs and Maint.[2]	52.76	154.40	728.70[4]
Operation[3]	16.00	24.00	60.00[5]
Total	$108.26	$280.30	$1832.10
Cost per day[6]	$ 0.433	$ 1.121	$ 7.328
Cost per hour[7]	$ 0.054	$ 0.140	$ 0.916

Notes:

[1] Five years straight depreciation.

[2] 50 hours of labor plus 10 per cent of total investment for spare parts.

[3] 2000 kwhr at $\frac{\$0.008}{\text{kwhr}}$ in 1929 and at $\frac{\$0.012}{\text{kwhr}}$ in 1955.

Consumption of one kw per hour during 2000 hours includes cost of compressed air.

[4] 100 hours of labor at $\frac{\$2.07}{\text{hour}}$ plus 10 per cent of total investment.

[5] 5000 kwhr at $\frac{0.012}{\text{kwhr}}$ per year of 2000 hours, consumption given by manufacturer.

[6] 250 days per year.

[7] 8 hours per day.

Equipment for electrostatic spray has been available since the late 'forties; numerous factories utilize the method but no direct information from users was secured (nor was it possible to obtain statistics of sales of electrostatic spray equipment). The required cost comparisons were therefore made on an indirect basis.

The prices for equipment delivered at point of use were as shown in Table I.

The hourly costs of using the equipment in the alternative methods at the various dates are shown in Table II.

Production workers in the factory which was studied earned \$0.71 an hour in 1929 and \$2.35 an hour in 1955 — an increase of 232 per cent. Maintenance workers at the factory earned \$0.66 an hour in 1929 and \$2.07 an hour in 1955 — an increase of 215 per cent. These figures are the arithmetic averages of the average hourly earnings reported weekly in the 'Rates and Hours Report' of the factory which reported for other categories as well as for production and maintenance workers. The figures just quoted are used in the appropriate cost estimates in Table II and the next section.

Comparisons of Cost per Unit of Output: The following formulae were used in order to arrive at unit costs (the machine costs per day being derived from Table II):

$$\text{(I) Unit Cost of Hand Spray} = \frac{\text{Machine cost per day} + N\,(\text{Power cost per day}) + N\,(\text{Average hourly earnings})}{N\,(\text{Hourly rate of production})}$$

$$\text{(II) Unit Cost of Electrostatic Spray} = \frac{\text{Machine cost per day} + N\,(\text{Power cost per hour}) + \text{Set up cost}}{N\,(\text{Hourly rate of production})}$$

where N is the number of hours for which the plant is in operation and is given various values up to 8 hours for the purpose of the detailed cost comparisons. In the case of electrostatic spray the set-up cost is the cost of the labor estimated as required for checking and adjusting the operation daily; it has been taken as equal to the average hourly earnings of a production worker.

The hourly rate of production for both methods is fixed by the conveyor speed for a given product mix, see Table IV. With the indicated product mix and a speed of 3.5 ft./min. the rate of production is 66 pieces per hour. This rate of production is also taken as the basis for one set of estimates of costs when using electrostatic spray. The electrostatic spray system has, however, the further advantage that the conveyor speed, limited by the human factor with hand spray, can be increased to the maximum speed for which

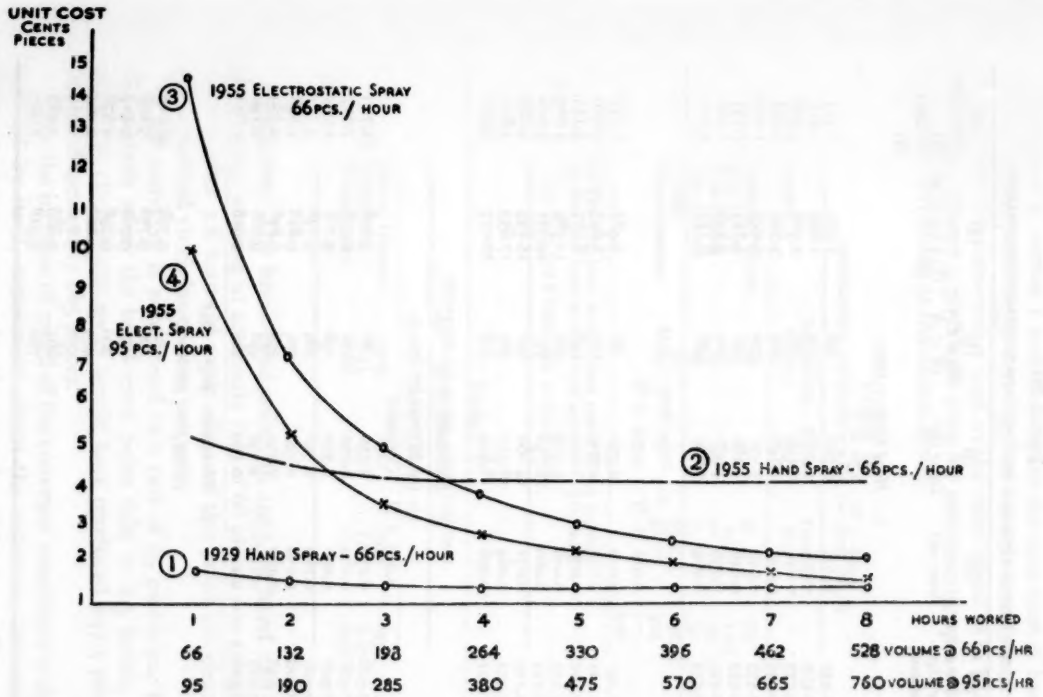

FIGURE 1

Cost per unit for painting elevator parts by hand spray and electrostatic spray, according to volume of work done, under 1929 and 1955 Labor and Machine Costs prevalent at the factory studied.

TABLE III

UNIT COST COMPARISONS FOR HAND AND ELECTROSTATIC SPRAYING

N	(1) *Machine cost per Day (Constant)*	(2) *Power cost*	(3) *Labor Cost*	(4) *No. of Pcs. 66 × N*	(5) (1)+(2)+(3)	(6) *Unit Cost* (5) / (4) *Cents*
			1. Hand Spray — 1929			
		0.008 × N	0.71 × N			
1	0.433	0.008	0.710	66	1.151	1.744
2	0.433	0.016	1.420	132	1.869	1.416
3	0.433	0.024	2.130	198	2.587	1.306
4	0.433	0.032	2.840	264	3.305	1.252
5	0.433	0.040	3.550	330	4.023	1.219
6	0.433	0.048	4.260	396	4.741	1.197
7	0.433	0.056	4.970	462	5.459	1.182
8	0.433	0.064	5.680	528	6.177	1.170
			2. Hand Spray – 1955			
		0.012 × N	2.350 × N			
1	1.121	0.012	2.350	66	3.483	5.277
2	1.121	0.024	4.700	132	5.845	4.428
3	1.121	0.036	7.050	198	8.207	4.145
4	1.121	0.048	9.400	264	10.569	4.003
5	1.121	0.060	11.750	330	12.931	3.918
6	1.121	0.072	14.100	396	15.293	3.862
7	1.121	0.084	16.450	462	17.655	3.821
8	1.121	0.096	18.800	528	20.017	3.791
			3. Electrostatic Spray – 1955			
			(a) *66 pieces per hour*			
		0.030 × N	(Constant)			
1	7.328	0.030	2.350	66	9.708	14.709
2	7.328	0.060	2.350	132	9.738	7.377
3	7.328	0.090	2.350	198	9.768	4.933
4	7.328	0.120	2.350	264	9.798	3.711
5	7.328	0.150	2.350	330	9.828	2.978
6	7.328	0.180	2.350	396	9.858	2.489
7	7.328	0.210	2.350	462	9.888	2.140
8	7.328	0.240	2.350	528	9.918	1.878
			4. Electrostatic Spray – 1955			
			(b) *95 pieces per hour*			
1				95	9.708	10.219
2				190	9.738	5.125
3				285	9.768	3.427
4				380	9.798	2.578
5				475	9.828	2.069
6				570	9.858	1.729
7				665	9.888	1.487
8				760	9.918	1.305

the conveyor has been designed and without additional expenditure of money. This maximum speed, 5 ft./min., will increase production to 95 pieces per hour with a corresponding reduction in unit costs.

In Figure 1, curves 1 and 2 compare the unit costs of hand spray systems in 1929 and 1955, curve 3 gives the unit costs for electrostatic spray when the conveyor is kept at the same speed as in hand spray operation. Curve 4 gives unit costs for electrostatic spray when the conveyor is running at maximum speed.

TABLE IV

PRODUCT MIX AND HOURLY RATE OF PRODUCTION

Product	*Product Mix % Bars*	*Pcs. per Bar*	*Total no. Pcs.*[1]	
Hoistway Doors	19	3	29 × 3	87
Cab Doors	3	3	4.5 × 3	13.5
Cab Panels	13	2½	20 × 2.5	50
Cab Domes	10	2	15 × 2	30
Frames	30	1	45.5 × 1	45.5
Miscellaneous	25	8	38 × 8	304
				530

66 Pcs. per hour at conveyor speed of 3.5 ft./min.
95 Pcs. per hour at conveyor speed of 5 ft./min.
[1] 152 Bars per 8 hour day at 3.5 ft./min.

TABLE V

BEHAVIOR OF LABOR COST OVERTIME

	Average Hourly Earnings ($)			
Class of Workers	*1929*	*1939*	*1949*	*1955*
Production	0.71	0.90	1.89	2.35
Maintenance	0.66	0.70	1.59	2.07

Conclusions: The break-even point, in 1955, of hand and electrostatic spray working at an hourly rate of 66 pieces was at 238 pieces, namely after 3.6 hours of work. Beyond this point the electrostatic spray method yields lower costs per unit.

If the conveyor is accelerated to a rate of 95 pieces per hour for electrostatic spray the break-even point falls to 2.5 hours; at that point the electrostatic spray would have produced 237.5 pieces and the hand spray only 165 pieces.

Since the increase of speed of the conveyor constitutes a change of method by itself, conclusions about the economic convenience of electrostatic spray versus hand spray, should be drawn from comparison of curves obtained with a rate of production of 66 pieces per hour.

Furthermore, it could be said that taking into account the known tendency of labor cost to rise over time, production methods where the main component of cost is machine cost, should be preferred.

The behavior of labor costs from 1929 to 1955, at the factory where the study was made, are given in Table V.

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APPENDIX

CHANGES IN MAN-HOUR, MACHINE-HOUR, AND POWER COSTS

Details of the changes in man-hour, machine-hour and power costs are given in Table VI. It can be seen that average hourly earnings have increased by 232 per cent between 1929 and 1955; the corresponding increase in cost, per hour of utilization, of equipment used in hand spray is 160 per cent.

The number of machine-hours equal in cost to one man-hour in hand spraying have increased by 28 per cent from 1929 to 1955, but as Table III shows labor cost is the predominant cost for this system. Using the newer electrostatic method the number of machine-hours equal in cost to one man-hour is much lower than for hand spray, nevertheless unit costs are much lower because machine cost is the predominant factor in overall costs, as Table III shows.

TABLE VI

MAN-HOUR AND MACHINE-HOUR COST FOR OPERATION STUDIED TOGETHER WITH COST OF POWER

Cost Category	*1929*	*1955*	*% change*
1. Average hourly earnings ($)	0.71	2.35	+232
2. Cost/hour of equipment for hand spray ($)	0.054	0.14	+160
3. Cost/hour of equipment for electrostatic spray ($)	—	0.916	—
4. Number of hand-spray machine-hours equal in cost to one man-hour (1/2)	13.148	16.875	+ 28
5. Number of electrostatic spray machine hours equal in cost to one man-hour (1/3)	—	2.565	—
6. Cost of power (kwh) – industrial use ($)	0.008	0.012	+ 50

II. TRENCH DIGGING

by JOHN SURIDIS

Introduction: The data presented in this report were obtained from records and/or supervisors of an eastern seaboard utility company. The purpose of the operation is to dig a trench to house various types of ducts through which are installed cables to supply electric service to the utility's customers. The ducts provide protection to the cables and the trench, when backfilled, reduces the exposure. The trench is eighteen inches wide and twenty-two inches deep. The length depends on the required run of the installation.

Two methods of performing this operation have been selected. One is by means of hand labor. The laborer with the aid of a shovel digs the required size trench. The other method is by a machine called a trencher. It is gasoline driven and operated by a worker classified as a trencher operator. The machine 'scoops' up the earth by means of shovel buckets mounted on the circumference of a motor-driven wheel. From the buckets, the earth is automatically 'dumped' alongside the hole it came from, thereby facilitating backfilling as in the case of the hand operation.

There are different types of terrain. For the purpose of this study, a normal terrain has been selected. This consists of average degree of earth hardness with no man-made covering and no obstacles in the trench run.

Years selected and data used: Data for eight selected years from 1938 to 1955 are used in this study. 1938 has been selected as the base year for various comparisons.

Cost of equipment: The total cost of the trencher, its associated equipment and freight for the selected years appears in the first column of Table I. From the lower part of the same table it can be seen that this cost increases 95 per cent from 1938 to 1955.

Hourly cost: The cost per hour for operation of the trencher (excluding direct operative cost) was obtained directly from data computed and recorded by the Controller's Office of the utility company concerned. It includes the depreciation of the original cost of the equipment on a twenty-five-year base, repairs and maintenance, fuel and insurance. The resulting figures are given in the second column of Table I. There was a 109 per cent increase in hourly cost from 1938 to 1955.

The hourly earnings of the trencher operator are given in column 3 of Table I and those of the laborer in column 4. Both show a sharp

rise by 1955 as compared with 1938: 179 per cent for the operator and 210 per cent for the laborer.

Machine-hour to man-hour costs: Table I also shows the relationship between machine-hour and man-hour costs, column 5 for the trencher *v.* operator and column 6 for the trencher *v.* laborer. In both cases there has been an increase in this ratio since 1938; the average earnings of labor increased in greater degree than did the hourly cost of operation of the trencher machine. As a result, 34 per cent more machine-hours of trenching operation could be purchased at the price of an operator man-hour in 1955 than in 1938.

TABLE I

TABULATION OF PURCHASE PRICE AND COSTS INVOLVING OPERATION OF TRENCHER MACHINERY FOR SELECTED YEARS

YEAR	(1) Delivered Cost of Trencher* (Dollars)	(2) Cost per Hour of Trencher (Dollars per hour)	(3) Average Hourly Earnings of Trencher Operator (Dollars per hour)	(4) Average Hourly Earnings of Trench Laborer (Dollars per hour)	(5) Number of Machine-Hr. Equal in Cost to Man-Hr. of Operator Col. 3/Col. 2	(6) Number of Machine-Hr. Equal in Cost to Man-Hr. of Laborer Col. 4/Col. 2
1938	5876.20	.90	.74	.50	.82	.53
1940	6152.00	.95	.81	.57	.85	.60
1942	6460.40	1.02	.89	.65	.87	.64
1945	7052.60	1.18	1.04	.80	.88	.68
1947	8400.00	1.42	1.39	1.06	.98	.75
1950	9510.60	1.58	1.62	1.21	1.03	.77
1952	10,893.00	1.72	1.82	1.37	1.06	.80
1955	11,451.30	1.88	2.06	1.55	1.10	.83
	AS PERCENTAGES OF 1938 VALUES					
1938	100	100	100	100	100	100
1940	105	110	110	114	104	113
1942	110	117	120	130	106	121
1945	120	131	141	160	108	128
1947	143	157	188	212	119	141
1950	162	175	219	242	125	145
1952	185	191	246	274	129	151
1955	195	209	279	310	134	157

* Including associated equipment.

Changes in the relation of unit costs to volume of work: In this example, an analysis of the 1938 and 1955 patterns of unit cost in relation to a varying volume of work done per day will be made by illustrating the alternative unit costs of doing the operation by manual and by machine methods.

It is estimated that a laborer can dig 2.5 feet of an 18 in. × 22 in.

trench per hour. The cost of doing this work by hand takes into account the hourly wage of the worker doing the job. The cost per day of the use of the hand shovel is not included because it is negligible.

In the case of the trencher, it is estimated that 25 feet of earth can be removed in an hour to form the required trench size. The cost of this work includes both the costs of the machine and the operator's wages. The fuel cost was included in the machine cost since it is less than 2 per cent of the total.

TABLE II

UNIT COST FOR VARIOUS HOURS WORKED BY THE TRENCHER

1938

Hours Worked per day (N)	(1) *Machine Cost per day* ($)	(2) *Labor Cost* ($)	(3) *Total Cost* (1)+(2) ($)	(4) *Number of Feet dug* $(N)\times 25$	(5) *Unit Cost* (3)/(4) ($)
.5	$0.90\times 8=7.20$	0.37	7.57	12.5	.606
.75		0.555	7.755	18.75	.414
1.0		0.74	7.94	25.0	.318
1.5		1.11	8.31	37.5	.222
2.0		1.48	8.68	50.0	.174
2.5		1.85	9.05	62.5	.145
3.0		2.22	9.42	75.0	.126
4.0		2.96	10.16	100.0	.102
5.0		3.70	10.90	125.0	.087
6.0		4.44	11.64	150.0	.078
7.0		5.18	12.38	175.0	.070
8.0		5.92	13.12	200.0	.066
		1955			
.5	$1.88\times 8=15.04$	1.03	16.07	12.5	1.29
.75		1.54	16.58	18.75	.89
1.0		2.06	17.10	25.0	.69
1.5		3.09	18.13	37.5	.48
2.0		4.12	19.16	50.0	.38
2.5		5.15	20.19	62.5	.32
3.0		6.18	21.22	75.0	.28
4.0		8.24	23.28	100.0	.23
5.0		10.30	25.34	125.0	.20
6.0		12.36	27.40	150.0	.18
7.0		14.42	29.46	175.0	.17
8.0		16.48	31.52	200.0	.16

The unit cost per foot removed by manual methods is as foliows:
Unit cost per foot = Labor cost per hour/2.5 feet per hour.
(*a*) for 1938: unit cost = 0.50/2.5 = 0.20$;
(*b*) for 1955: unit cost = 1.55/2.5 = 0.62$.

Unit cost per foot of earth removed by the trencher is calculated as follows:

$$\text{Unit cost} = \frac{\text{Machine cost per day} + N(\text{Labor cost per hour})}{N\,(25)}$$

where N = the number of hours worked per day.

(*a*) for 1938: unit cost = $(7.20+0.74N)/25N$;

(*b*) for 1955: unit cost = $(15.04+2.06N)/25N$.

Table II gives the resulting estimates of the unit costs for the trencher when working for various lengths of day in 1938 and 1955.

Figure I shows the results of these costs estimates. The solid lines in the chart show the units costs for manual and machine methods in 1938. The broken lines represent the 1955 costs. Both the 1938 and 1955 manual operation unit cost curve is a straight line parallel to the X axis because this cost is composed of the laborer's wage which is constant per hour during the regular day's work. Whereas, in the machine operation the curve is composed of a constant value per hour (trencher operator) and a varying value (machine cost). Therefore, the unit cost diminishes with an increase in machine usage.

The following observations can be made:

1. The shift of the break-even point between machine and manual operation was downward from 1938 to 1955. In 1938 it was 45 feet as compared with 30 feet in 1955 (66 per cent of the 1938 break-even point).

2. The cost of doing this work manually rose by 1955 from .50 to 1.55 dollars per hour, a rise of 210 per cent over the 1938 figure.

3. The cost of doing this work by the trencher rose 125 per cent at the four-hour point.

4. The changes in labor and machine costs from 1938 to 1955 widened the gap between the manual mechanized costs of doing the same work. At the four-hour point, manual methods in 1938 cost 0.098 dollars per unit more than machine methods. In 1955, the difference was .39 dollars or an increase of 300 per cent over 1938.

Conclusions:

(1) There has been an increase in purchase price of equipment, operating cost of workers and the ratio of machine-hour to man-hour costs from 1938 to 1955.

(2) However, the rise in cost of manual labor has been at a much faster rate than the rise in machine costs.

(3) The ratio of labor to machine hour cost, the break-even point between manual and machine hour methods each show this effect.

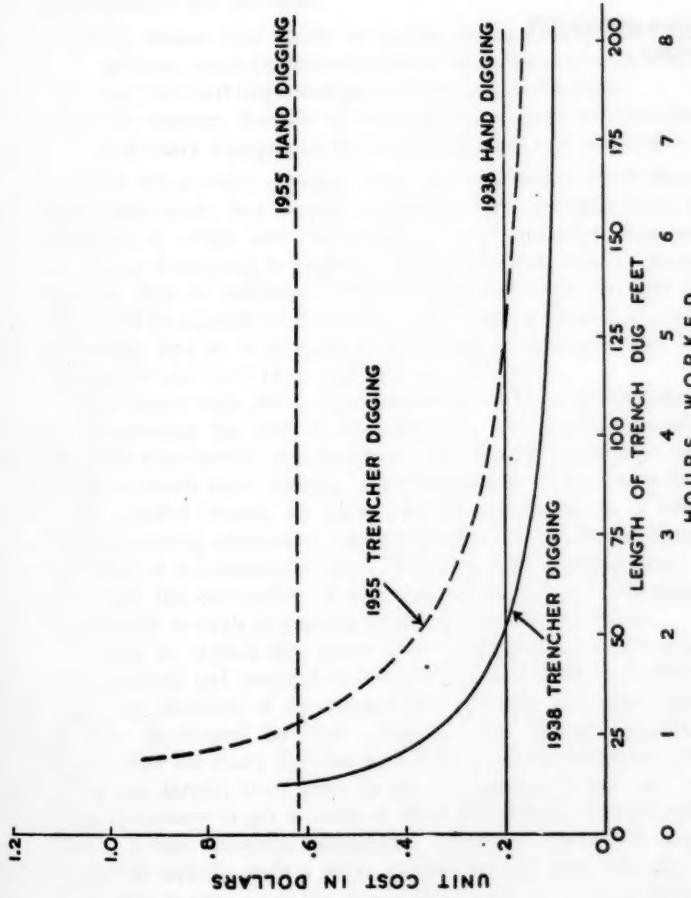

FIGURE 1

Cost per unit for digging 18 × 22 inch trench by hand labor and by trencher, according to the volume of work done, under 1938 and 1955 Labor and Machine Costs for a utility in the United States.

(4) The consequence is that in 1955 production by the machine method was relatively much cheaper than production by the hand method and in comparison with the 1938 position the advantage of using the machine for trenches of more than moderate length had increased disproportionately.

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FINANCIAL PROVISION FOR RESEARCH AND DEVELOPMENT IN INDUSTRY[1]

by J. F. COALES

THE reasons for an industrial concern carrying out research and development are two-fold:

(1) To ensure that when, in maybe ten or twenty years' time the present products manufactured have become obsolete, there are new and improved products to take their place.

(2) To ensure that as a manufactured product changes, the necessary equipment for manufacturing it is available.

Until the present century, very few manufactured products became unsaleable, but modern conditions have brought about a state of affairs in which new materials and new manufacturing methods are being developed so rapidly, and public taste can be changed so rapidly, that no manufacturing firm can feel confident that its products will be saleable in five or ten years' time without major changes in design, and in some cases a full range of products may become unsaleable and have to be replaced by other lines.

At the same time, since rapid advances can be made by competitors in cheapening the cost of manufacture, new production methods must be continually developed so that capital equipment becomes obsolete much more quickly than heretofore. Thus, as a corollary to the second reason, we must add the development of improved manufacturing methods of existing products to enable production to continue at a competitive cost. Research and development, therefore, are the equivalent of new capital equipment and should be considered as such in making financial provision for them.

It may be argued that there is no need for a manufacturing concern to carry out research and development on the basis that it can copy the products of its competitors and can buy any equipment already developed for their manufacture. When products were marketable for many decades with little or no modification, this was, of course, largely true, since in the circumstances the two or three years necessary to get a product on to the market seemed relatively short. Under modern conditions, however, when the market is changing rapidly, such a delay cannot be afforded, and the history of the past twenty years has shown that in the newer industries, as for example, the electrical industry, larger expenditure on research and

[1] This paper was prepared by the author in 1955 for consideration by a large manufacturing business which was reviewing its research and development policy.

development has paid handsome dividends for the reasons already stated. Moreover, as more advanced methods of manufacture are employed, the time taken to get a new production line into being on an economical basis becomes greater. What, ten years ago, would have taken one or two years to get on the market would now take two or three years, and in ten years' time will probably take four to five years, whereas the life of the product before it becomes at least obsolescent is continually decreasing.

If a firm has no research and development organization, its chief source of information concerning the development of its competitors is its customers via its Sales Organization. This means that it will only hear of its competitors' new developments after they have been announced to customers, which will not be until production is well under way. It is then necessary for the firm to find out all about the manufacture of the new product and buy in equipment for its manufacture. We will assume that there is adequate technical staff to do this when they know what the manufacturing processes are, but unless there is, at any rate, a development laboratory there will be no one to decide what those new processes are until the competitors' product is actually on the market, and even then they may be well-kept secrets. If there had been a Research and Development Department on the other hand, it would have been in touch with developments throughout industry, not only in this country but all over the world and, if it is doing its job properly, it is very unlikely to miss an important development for more than a few months, whereas to commercialize a new development takes the best part of five years. Thus the Technological Department's first job is to keep the management informed of technical developments likely to affect the nature of the Company's business. This it will only be able to do effectively by doing good development work itself because it is only then that other scientists and engineers will discuss with its members what they are doing and it is also only then that they will be able to appreciate the importance or otherwise of the work other people are doing. It is for these reasons that the Technological Department must be the spearhead of the Company's Intelligence Service.

When the time comes to develop new products to compete with one's competitors, slavish copying is always uneconomic, since no two organizations are the same and the processes to be used have been developed for another organization. So here again the Technological Department has a most important part to play in rapidly developing manufacturing methods suited to its own firm, which can only be done if high grade work along similar lines has been going

on for several years previously. There is no subsitute for first-hand experience.

The amount that any business should spend on research and development will, of course, depend, not only on its size, but also on the nature and variety of its products and cannot be directly related to its annual turnover. Thus, an instrument firm, whose products are likely to have to be changed rapidly on account of new developments in measurement, might justify an expenditure of 10 per cent of its turnover on research and development, whereas a biscuit manufacturer might feel that his products would be required without appreciable change for at least twenty years, and might, therefore, only be able to justify say ½ per cent of turnover, and the research and development carried out would be concerned almost entirely with improving manufacturing methods. It is evident, therefore, that the correct percentage of turnover to be spent on research is anybody's guess, and will vary between wide limits, depending on the nature of the business, and on the trend of world needs. However, there is now a great deal of experience available, and since it is dangerous to lag appreciably behind one's competitors, limits can be placed on what this expenditure should be. An investigation by the Federation of British Industries showed that in 1950-51 the expenditure on research and development in a very wide range of industries varied from 0.4 to 5.3 per cent. The great value of arriving at some rough estimate on these lines is that the resulting figure can be compared with estimates derived by other means, such as the size of organizations considered necessary on technical grounds, the relation to capital expenditure, etc. It will usually be found that the various estimates are not far different so that confidence can then be placed in the result.

Unless a firm is large other considerations have to be taken into account, because research and development does not flourish unless a medium sized research department can be established. This medium size, to be effective, is of the order of twenty to thirty engineers and scientists, calling for an annual expenditure of about £100,000 per annum. This is the reason that there has been so little effective research in the instrument industry, which is almost entirely made up of small firms. The amount of research and development required will, of course, be dependent on the variety of products manufactured — the greater the variety, the larger the required expenditure on research. It is probable that any firm which can afford an annual expenditure of at least £100,000 per annum will be making a variety of products, and although the research and development laboratories must cover all aspects of the Company's

business, it is unlikely that many products will become obsolete at the same time, and so, although the work of research and development must be more diverse, the risk of failure is much reduced. There is some advantage also in that techniques developed in one connection are usually found to help in others and the cross-fertilization of ideas that goes on in a larger research establishment results in very much better results. The optimum size of a research establishment is fairly closely prescribed, and many people think that a staff of about 500 in all is as large as is efficient, giving a maximum annual expenditure of about £800,000 per annum. If more research and development than this is required, it is usually considered best to divide the department into two or more separate and autonomous laboratories.

Conclusions

Following the above discussion, it is therefore concluded that taking the long view the annual provision for expenditure on research and development should be linked with the annual turnover, since it is only by adequate research that this annual turnover can be maintained or extended. This particularly applies to long term research as opposed to development. Development is usually more concerned with manufacturing processes than with development of new products, and can therefore be closely linked with the capital replacement programme and the annual expenditure on new equipment. Certain parts of the development departments will be entirely concerned with improvements to plant, and since it is now common for 10 to 15 per cent of the capital expenditure on a process plant to be on instruments and most of the plant developments of the next few years will be concerned with improvement of control, an annual expenditure of 10 per cent of that set aside for capital replacement each year would seem a reasonable amount to spend on this type of development.

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